PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

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Non-destructive testing
Industrial radiography
Corrosion
Electrical and magnetic measurements and instruments
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Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page 3 of cover*

MATHEMATICS 51

12.2 : 518.43 *see Abstr.* 3003

: 621.317.7 : 531.252 *see Abstr.* 3065

3 : 517.512.2 3003

aphical methods for evaluating Fourier integrals. NINGHAM, W. J. *J. Appl. Phys.*, **18**, 656–62 (*July*, —Three procedures are described, all based upon amental properties of the transforms. Each involves alysis of the curves of the function to be transformed um of curves of simpler functions whose transforms nown. The methods are useful in cases where the lem is too complicated for a simple analytic solution, here part of the necessary data is available only in orm of a curve obtained, say, from experimental urements of transmission characteristics or wave s. The accuracy of the methods is restricted only at of the graphical plotting and curve fitting. A.

: 548.735 *see Abstr.* 3359

4 : 537.542 : 621.318.57 3004

n some fluctuation problems connected with the count- of impulses produced by a Geiger–Müller counter or ation chamber. VAN DER VELDEN, H. A., AND T, P. M. *Physica, 's Grav.*, **9**, 641–56 (*July*, 1942).— essions are derived for the statistical fluctuations in number of counts indicated by: a direct counting- meter; an integrating counting-rate meter; a scaling unit with mechanical recorder. Account is taken in turn, and in some combinations, of the resolving time of the counter, the recovery time of the scaler, the scaling factor, and the recovery time of the mechanical recorder. L. E. M.

519.3 : 530.12 = 4 3005

A contribution on the infinitesimal transformations of tensors and spinors. DE DONDER, T., AND GÉHÉNIAU, J. *Bull. Acad. Belge Cl. Sci.* (*Sér.* 5) **33**, 641–55 (*Dec.*, 1946) *In French.*—An arbitrary change of co-ordinates in a space can be expressed as a contact transformation involving a parameter explicitly. The corresponding transformations of tensors are obtained. They can be adapted for spinors. G. J. K.

519.3 : 530.12 = 4 3006

The extension to spinors of the fundamental identities of mathematical physics. DE DONDER, T. *Bull. Acad. Belge Cl. Sci.* (*Sér.* 5) **33**, 108–18 (*March–April*, 1947) *In French.*—Methods previously discussed [see Abstr. 3005 (1947)] are used to derive the identities, or field equations, satisfied by density functions over a given space, by virtue of their invariance under general transformations in the space. The derivation is equally valid if the functions involve spinors as well as tensors. G. J. K.

519.4 : 530.145 = 4 *see Abstr.* 3055

ASTRONOMY . ASTROPHYSICS . GEODESY 52

)38 : 538 : 523.87 *see Abstr.* 3032

21 : 535.317.9 *see Abstr.* 3110

24 = 4 3007

he clarity of an objective for stars and the expression he limit of magnitude. ROY, L. *C.R. Acad. Sci., s*, **224**, 1088–91 (*April* 14, 1947) *In French.*—A note ng formulae to express the transmission and limit of nitude of astronomical objectives on point sources. E. G. M.

617.2 : 771.534.56 : 535.242.43 3008

n the use of rotating sectors in astronomical photo- y. COUSINS, A. W. J., AND STOY, R. H. *Mon. Not. Astr. Soc.*, **106** (*No.* 4) 286–91 (1947).—With 2 kinds mulsion, a sector giving 100 or more interruptions per acts as if it reduced by the appropriate geometrical or the intensity of the incident light rather than the osure time. A. HU.

11 3009

he time-scale of the universe. BOK, B. J. *Mon. Not. Astr. Soc.*, **106** (*No.* 1) 61–75 (1946).—Evidence for short (4×10^9 yr) time-scale is found in the age of eorites, in the dynamics of the loose galactic clusters of dense star clusters, and in the statistics of wide aries. No conclusive evidence can be obtained from equipartition argument, from the distribution of the xies, from clusters of galaxies, or from considerations tellar evolution or of interstellar matter. No line of lence, however, now points to the long (4×10^{12} yr) e-scale. A. HU.

11 3010

he number of galaxies per unit volume. FLETCHER, A. *n. Not. R. Astr. Soc.*, **106** (*No.* 2) 121–3 (1946).— rrection of an error of statistical technique overlooked previous authors leads to a doubling of current mates of the space density of galaxies. A. HU.

.152.4 : 523.852.31 *see Abstr.* 2030

523.161 3011

Some phenomena connected with interstellar matter. OORT, J. H. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 3) 159–79 (1946).—The relation between interstellar clouds of gas and of solid particles is discussed. Several lines of argument make it likely that interstellar clouds are being continually created. The bright rims of many dark nebulae are attributed to luminosity produced by compression of two colliding clouds. If interstellar particles grow by sublimation of gas atoms on to condensation nuclei, the converse process of evaporation must go on until the observed balance is reached. The occurrence of absorption due to such "smoke" particles in extra-galactic nebulae is discussed with special reference to the formation of spiral arms. The deceleration apparently observed in the expanding shell round N. Persei 1901 is compatible with the suggestion that the luminosity is due to friction engendered by collision with an interstellar cloud. A. HU.

523.531 : 621.396.9 3012

Radar observations of meteors. HEY, J. S., AND STEWART, G. S. *Proc. Phys. Soc., Lond.*, **59**, 858–83 (*Sept.*, 1947).—An investigation of short-duration radio echoes observed at 4–5 metres wavelength in the neighbourhood of the E region of the ionosphere is described. Observations by vertical beam radio equipments showed that the echoes occurred most frequently at $\sim$95 km. Marked directional characteristics were revealed by the use of equipments with oblique beams, the diurnal variations being different on different bearings. Analysis of the results has indicated the close link in characteristics of these echoes and meteors, and has thus confirmed the suggestion of meteoric origin which has been made by some previous workers. A detailed correlation is demonstrated in the present investigation and a method is described for the determination of the radiants of the most active meteor streams. Further, a determination of

geocentric velocities was made possible by the introduction of improved photographic techniques for the observation of the Giacobinid meteor shower in October 1946. A.

523.72 : 523.877 = 4 *see Abstr.* 3042–3

523.746 3013

Sunspots and magneto-hydrodynamic waves. II. ALFVÉN, H. *Mon. Not. R. Astr. Soc.*, **105** (*No.* 6) 382–94 (1945).—The shape and orientation of the whirl rings previously considered [Abstr. 957 (1946)] are deduced when at the solar core by following the life-history of a bipolar spot. On a plausible assumption as to the magnetic field in the core, the whirl is almost circular and takes place usually in a plane ∥ to the magnetic field and almost ⊥ to the meridian plane. Such whirls (especially if they are large) are accelerated under the influence of a gravitational field, and certain observational data are explained by this process. There can be no division of the sun into a convective and a non-convective part because convection in one part gives rise to whirls and therefore to convection in other parts also. A. HU.

523.746 3014

On the inclination of the normal axes of sunspots. MINNAERT, M. G. J. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 2) 98–100 (1946).—From the asymmetry in the total area of spots about the central meridian, the inclination of their axes is derived independently of any assumption concerning the foreshortening. The inclinations found are 0·44° for all spots, 4·3° for 6·8° for long-lived spots, and 7·6° for recurrent spots. A. HU.

523.746 3015

Structure of sunspots. ODGERS, G. J. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 2) 101–7 (1946).—The contrast between spot and disc, the penumbra and the bright ring can be explained by assuming that a spot is a region where the product of the absorption coefficient and the density is > the same quantity for the disc. A. HU.

523.746 3016

The growth and decay of the sunspot magnetic field. COWLING, T. G. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 3) 218–24 (1946).—The variation with time of the magnetic field of a sunspot is studied for spots of lifetimes 30 and 55 days. If the magnetic field is produced by the darkening of the spot, it is established in at most a day, whereas purely electromagnetic growth or decay takes about 300 yr. The field must therefore exist before and after the visible spot: mass motion of the solar material is probably involved. A. HU.

523.752 3017

Electromagnetic forces in solar prominences. EVANS, D. S. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 4) 300–37 (1947).—The hypothesis that the shapes of and motions in prominences are due to ions moving in a magnetic field is examined. The dispersal of an ion cloud under its own local electrostatic repulsion gives velocities which agree with observed knot velocities if a background cloud of 10^{-11} or 10^{-12} charges/cm³ exists. A general electrostatic field above the solar surface may account for the support of prominences and the coronal ions. The forms of various types of prominence can be explained as the space tracks of knots moving in magnetic fields which can be located fairly closely. A mechanism is suggested for the form of tornado prominences. A. HU.

523.755 3018

Zodiacal light in the solar corona. VAN DE HULST, H. C. *Astrophys. J.*, **105**, 471–88 (*May*, 1947).—Allen's suggestion [Abstr. 3023 (1947)] that the apparent outer corona is largely light diffracted by particles between sun and earth, is independently advanced. The number of particles with radii between a and $a + da$ cm $3{\cdot}5\times10^{-20}\ a^{-2{\cdot}6}$ per cm³ (less when $a > 0{\cdot}035$ cm the albedo, $\sim 0{\cdot}1$. Large particles are 10 000 × numerous as telescopic meteors indicate. T. G.

523.755 : 523.775.5 *see Abstr.* 3023

523.774 = 4 30

On the intensity variations of the bands of CN and C molecules between the centre and limb of the solar di PECKER, J.-C., AND PEYTURAUX, R. *C.R. Acad. Sc Paris*, **224**, 1477–9 (*May* 28, 1947) *In French.*—Observ tions of $\log(I_0/I_\theta)$, (θ = angle between line of sight a normal to surface) are plotted against wavelengt Bands of CN show the greatest departure from phot spheric values for sin $\theta = 0{\cdot}91$. D. L.

523.774 : 550.385 30

Some observations of the *H* and *K* lines in the sol spectrum during a magnetic storm. BRÜCK, H. A., AN RUTLLANT, F. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 130–4 (1946).—Photometric observations of the sol spectrum during the magnetic storm of Feb. 7, 1946, sh slight indications of a small depression in the vio wings of *H* and *K* such as would be produced by a clo of Ca ions moving towards the earth at 750 km/sec. A. H

523.775.5 30

On the excitation of the coronal spectrum. WOOLLE R. v. D. R., AND GASCOIGNE, S. C. B. *Mon. Not. Astr. Soc.*, **106** (*No.* 2) 113–20 (1946).—Saha's theo [Abstr. 2452 (1946)] is attacked on the ground that demands so high a neutron concentration that neutro proton captures would lead to the release of >10× t total solar energy output. Radioactive products of ½-li about a month transported to the solar surface from t deep interior are suggested as the source of the hi coronal temperature. A. H

523.775.5 30

The identification of the coronal lines. EDLÉN, *Mon. Not. R. Astr. Soc.*, **105** (*No.* 6) 323–33 (1945). Extreme ultra-violet transitions in Fe X, Fe XI, Ca and Ca XIII give ground-level separations in these io which correspond to 4 strong coronal lines. Extr polation along isoelectronic sequences leads to t identification of lines comprising 95% of the total coror line emission with transitions in these ions and in Fe X Fe XIV, Ni XII, Ni XIII, Ni XV and Ni XVI. The intensit to be expected accord with those observed if the excitati is by electron collision, the electron temperature bei 250 000° and the abundance ratio Fe/Ni being 100/5 Various theories proposed to account for the hi excitation are discussed. A. H

523.775.5 : 523.755 30

The spectrum of the corona at the eclipse of 19 October 1. ALLEN, C. W. *Mon. Not. R. Astr. So* **106** (*No.* 2) 137–50 (1946).—Wavelengths and intensit are given for 7 emission lines. The continuous spectru is redder away from the sun than close to it. Absorptio line intensities in the outer corona are used to obtain t proportion of the light due to the Fraunhofer compone This proportion is independent of wavelength b increases with distance from the sun. The observatio confirm Grotrian's theory [Abstr. 2396 (1934)] exce that the Fraunhofer component is more likely to due to diffraction by interplanetary particles than reflection. A. H

523.823 : 523.87 *see Abstr.* 3033

523.841.1 30

Explosions in stars, resulting from nuclear reactions, a possible cause of outbursts of novae and supernov

EVICH, L. Z., AND LEBEDINSKY, A. I. *C.R. Acad. URSS*, **56** (*No.* 1) 23–5 (1947).

341.1 = 3 3025

n the theory of novae. MICZAIKA, G. *Z. Naturh.*, **2a**, 216–19 (*April*, 1947) *In German.*—Suggests existing theories should be modified to allow for the ibility of recurrent nova outbursts. R. A. N.

841.11.035.924.2 3026

n the deep minimum in the light curve of slow novae. HAAR, D. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 4) 5 (1947).—This phenomenon is explained by assumthat a molecular cloud is formed in the neutralrogen region between the outermost shell and the one. A similar effect can account for the fluctuations rightness of fast novae. The process is consistent the eventual formation of a planetary nebula from w nova. A. HU.

842 : 523.852.31 *see Abstr.* 3029

852 = 4 3027

nebular model. LEMAÎTRE, G. *Ann. Soc. Sci. x.*, **60** (*Sér.* 1) 103–14 (*July* 31, 1946) *In French.*—siders the motion of a spherically symmetrical ribution of matter under the action of gravitation and nic repulsion, these two forces neutralizing each other the boundary. The distributions of density and ential throughout the system are tabulated. R. A. N.

852.3 = 4 3028

he macroscopic distribution of the extragalactic ulae. DRUMAUX, P. *Ann. Soc. Sci. Brux.*, **60** (*Sér.* 1) 21 (*July* 31, 1946) *In French.*—Extends previous k on radial velocities [Abstr. 558 (1937)], to obtain result that the space distribution of the nebulae can epresented approximately as a linear function of the ance. [See also Abstr. 2009 (1947)]. R. A. N.

852.31 : 523.842 3029

On the structure of the disk-shaped extragalactic ulae. III. On the formation of multiple systems. YLE, F. *Mon. Not. R. Astr. Soc.*, **105** (*No.* 6) 62 (1945).—Binary stars can only form from neighring regions of condensation in a disc-shaped nebula sisting largely of interstellar H. The angular mentum of a binary can be closely estimated from the ial masses of its components. This estimation is ried through for nearly 50 binaries and results in ial masses less by $\sim 10\times$ than the observed masses. e discrepancy is attributed to accretion of H after mation, as also are certain correlations observed in ary systems. The work is extended to triple and adruple systems, and statistical results to be expected ccretion occurs at a rapid rate in such systems are ived. A. HU.

852.31 : 523.152.4 3030

On the structure of disk-shaped extragalactic nebulae. The effect of internebular material on accretion by rs. HOYLE, F. *Mon. Not. R. Astr. Soc.*, **105** (*No.* 6) 81 (1945).—The dynamics of an encounter between ebula and diffuse material lying between the nebulae nvestigated. The process is shown to produce changes the velocities of the stars relative to the interstellar terial and to alter the identity of the stars undergoing id accretion. These results are applied to the problem the origin of spiral arms, and the stability of axially mmetric nebulae is investigated. A. HU.

852.32 : 530.12 3031

On the spiral character of the external galaxies. LNE, E. A. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 3) 0–99 (1946).—Orbits of particles in the gravitational ld of a massive nebula nucleus, Keplerian on the dynamical time-scale, are open equiangular spirals on the kinematic time-scale. Such orbits cannot have an envelope; and the condition for this gives the present positions of the particles forming a nebular arm. This locus gives the arm a finite number of convolutions in the sense of the orbital motion and then unwinds it in a retrograde sense. This two-part structure, one interior to a critical distance and the other exterior, may account for current discrepant conclusions on the sense of winding. Barred spirals are possibly systems for which the number of convolutions is small. A. HU.

523.87 : 521.038 : 538 3032

Remarks on stellar magnetism. BABCOCK, H. W. *Publ. Astr. Soc. Pacif.*, **59**, 112–24 (*June*, 1947).—Zeeman effects detected in 78 Vir., γ Equ., β Cor. *B*, and *HD* 125248 indicate that rapidly rotating stars of early type possess much stronger fields than does the sun. [See Abstr. 1413 (1947)]. It is suggested that the possession of magnetic fields may be a general property of metallic-line *A* stars. Magnetic effects in a stellar atmosphere are also discussed. R. A. N.

523.87 : 523.823 3033

Luminosity criteria from objective-prism spectra for stars from F0 to K5. NASSAU, J. J., AND VAN ALBADA, G. B. *Astrophys. J.*, **106**, 20–7 (*July*, 1947).—This paper continues work on luminosity criteria of stars [see Abstr. 2023 (1946)]. Using short spectra of 126 stars, a luminosity classification for stars from types F0 to K5 is derived. No simple scheme is possible owing to the intermingling of variation with luminosity and change with spectral type. Drawings showing the intensity distribution have been used to overcome the loss of detail in the photographic reproduction of low dispersion spectra. This method should give accurate classification at least to the tenth magnitude for many spectral classes. E. G. M.

523.87 : 535.338 3034

The spectrum of β Pegasi. DAVIS, D. N. *Astrophys. J.*, **106**, 28–75 (*July*, 1947).—A thorough investigation of high dispersion spectrograms over the region 3 400–8 839 Å yields wavelengths (to 0·01 Å), intensities (visual estimates) and identifications (with all possible blending components considered) for 10 000 lines. In this typical M giant 45 elements (+ probably 11) are present. The most abundant molecules after TiO are MgH, SiH and AlH, with at least 12 others of less importance. Brief notes are given on the behaviour of atoms and molecules of special interest. D. L. E.

523.87 : 535.34 3035

The absorption continuum in the violet region of the spectra of carbon stars. SHAJN, G., AND STRUVE, O. *Astrophys. J.*, **106**, 86–91 (*July*, 1947).—An observed background intensity drop from 4 100 Å towards the violet is accompanied by weak line absorption not due to temp. or pressure effects (proved by normal line intensities elsewhere). Theory suggests, as the cause, true absorption by overlapping molecular bands of unknown origin. D. L. E.

523.872 3036

Non-coherent scattering and the absence of polarization in Fraunhofer lines. ZANSTRA, H. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 3) 225–7 (1946).—Physical arguments [Abstr. 1528 (1944)] that coherent scattering is rare in stellar atmospheres are confirmed by Redman's observations [Abstr. 1246 (1944)] that polarization is absent from Fraunhofer lines observed at the limb. A. HU.

523.872 : 535.343.1 3037

The continuous radiative absorption cross-section of O^-. BATES, D. R. *Mon. Not. R. Astr. Soc.*, **106** (*No.*

2) 128–9 (1946).—Cross-section curves for O^- [Abstr. 1971 (1943)] are extended to 10^5 cm^{-1} in view of possible astrophysical applications. A. HU.

523.875 3038

Stellar energy generation. WOOLLEY, R. v. D. R. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 4) 260–6 (1947).—An explicit relation between calculated central temp. and observed mass, luminosity and radius is developed for small non-degenerate gaseous masses with a given law of energy generation. Observational data do not support the idea that stellar compositions differ only in H content. Differences in H content between centre and surface may be important, and appreciable degenerate cores may exist in some stars. A. HU.

523.877 3039

Stellar opacity. WOOLLEY, R. v. D. R. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 2) 108–12 (1946).—The stellar absorption coefficient arising from classical oscillators distributed in frequency according to the law ν^{-n} corresponds to a Rosseland mean opacity $\propto \rho T^{-(3/2+n)}$ in giants or to T^{-n} in dwarfs. A constant distribution $n = 0$ is suggested. A. HU.

523.877 3040

On the general equations of stellar structure. LYTTLETON, R. A. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 3) 228–39 (1946).—The equation of state is obtained for convective equilibrium, including the radiation pressure term without approximation, and applied to the problem of calculating the distribution of density ρ and temperature T in stellar convective cores. The equilibrium equations can be integrated numerically, and ρ and T are derived as power series for 13 values of the ratio between the central gas pressure and the total pressure. The series are applicable to any likely size of convective core. The problem of fitting radiative envelopes to the solutions is discussed. A. HU.

523.877 3041

The chemical composition of the stars. HOYLE, F. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 4) 255–9 (1947).—The observed composition of interstellar material and o stellar atmospheres is inconsistent with the view tha 10% of the mass of a star is in the form of heavy elements if the star has condensed from interstellar matter it mus contain 99% H, and this proportion can be reduced onl by thermonuclear conversion of H to He. The effect o this on stellar luminosities is examined: the new theor agrees with observation at least as well as the old. A. HU

523.877 : 523.72 = 4 304

Variation in the law of darkening for monochromati radiation in the interior of the solar atmosphere in the cas of radiative equilibrium. PROISY, P. *C.R. Acad. Sci. Paris*, **224**, 1334–6 (*May* 12, 1947) *In French.*—A genera expression is set up for the variation in the intensity o radiation over the surface of a sphere in a stellar atmosphere, the coefficients of emission and absorptio depending upon depth in the atmosphere and upon th direction of radiation. R. A. N.

523.877 : 523.72 = 4 304

The law of darkening for monochromatic radiation a the surface of a star in radiative equilibrium. PROISY, P *C.R. Acad. Sci., Paris*, **224**, 1479–81 (*May* 28, 1947) *I French.*—A general expression for the intensity of radia tion in a stellar atmosphere [see Abstr. 3042 (1947)] i used to account qualitatively for the deviations o observations from an empirical law of darkening for th solar disc. R. A. N.

523.877 : 530.12 304

On a case of radiation equilibrium in general relativity theory and its bearing on the early stage of stellar evolution. KLEIN, O. *Ark. Mat. Astr. Fys.*, **34 A** (*Paper* 19) 11 *pp* (1947).—A spherically symmetric solution of the field equations is obtained for the case of disordered radiation. It is suggested that non-static solutions exist corresponding to stellar systems consisting wholly of radiation in a nearly stationary state. R. A. N.

PHYSICS 53

FUNDAMENTALS 530.1

530.12 = 4 3045

The principle of the inertia of energy and the notion of potential energy. DE BROGLIE, L. *C.R. Acad. Sci., Paris*, **225**, 163–5 (*July* 21, 1947) *In French.*—The determination of the additive constant in the potential energy is discussed and the difficulties of attributing an interaction energy to only one of the two particles involved, as is often done. G. J. K.

530.12 : 519.3 = 4 *see Abstr.* 3005–6

530.12. : 523.852.32 *see Abstr.* 3031

530.12 : 523.877 *see Abstr.* 3044

530.12 : 538 = 4 3046

On the magnetism of rotating masses. GIÃO, A. *C.R. Acad. Sci., Paris*, **224**, 1813–15 (*June* 30, 1947) *In French.*—The author's unified field theory [Abstr. 2018 (1947)] is used to show that the magnetic moment of an uncharged rotating sphere $= kG \times$ its angular momentum, k being a constant involving the mean curvature of space-time. Blackett's result [Abstr. 1715 (1947)] follows on the assumption $k = \beta/cG^{\frac{1}{2}}$. R. A. N.

530.14 3047

Classical charge interaction. GROENEWOLD, H. J. *Physica, 's Grav.*, **13**, 79–80 (*March*, 1947).—The classical radii of the charges are included in two suggested forms of the Lagrangian of their motion, so that the classical self-energy and the energy of pair annihilation are finite. G. J. K.

530.14 3048

Statistical geometry and fundamental particles. ROSEN, N. *Phys. Rev.*, **72**, 298–303 (*Aug.* 15, 1947).—To take account of the fact that the existence of a fundamental length a, the classical electron radius, sets a limit to the accuracy with which the position of a point can be measured, it is proposed to introduce two spaces, an "abstract" space consisting of points, and an "observable" space in which one deals with elementary volumes correlated to the points of the former by means of a statistical distribution function in the form of a 3-dimensional Gaussian error function. Such a function is not Lorentz-invariant, but one can obtain Lorentz-covariance in the observable space by carrying out the usual Lorentz transformation in the abstract space. If one assumes that the usual equations for wave fields, in which the fundamental particles are regarded as points, are valid in the abstract space, then one can obtain corresponding equations in the observable space, with the particles behaving as if they had finite volumes. The difficulties associated with ∞ self-energies and singularities in the interactions between particles, as calculated by the usual perturbation method, disappear, but the difficulty associated with the divergence of the series of successive orders of perturbations remains. A.

0.14 = 4 3049

The notion of a centre of gravity in relativistic wave chanics. SLANSKY, S. *J. Phys. Radium* (*Sér.* 8) **8**, 60 (*Feb.*, 1947) *In French.*—The momentum property the mass-centre in classical mechanics cannot be clearly fined in relativistic wave mechanics. However, with nany-time formulation, the wave-equation of a system N particles of spin $\frac{1}{2}$ has solutions which are functions the co-ordinates of a mass centre, defined as a mean er time and space co-ordinates. With this reduction e equation is that of a particle of spin $\frac{1}{2}N$. G. J. K.

0.145 3050

The energy-momentum tensor in projective relativity eory. PAIS, A. *Physica, 's Grav.*, **8**, 1137–60 (*Dec.*, 941).—After a summary of the formalism used to relate nsors in space-time to those in the 5-dimensional pro- tive space, a symmetric projective energy-momentum nsor is obtained for an arbitrary field, and conservation energy, momentum and charge is proved. The eneral method is applied to the Dirac field. G. J. K.

0.145 3051

Meson fields in projective space. PAIS, A. *Physica, Grav.*, **9**, 267–84 (*March*, 1942).—Using methods reviously described [Abstr. 3050 (1947)], the basic pes of meson fields in projective space are listed. The uclear source densities of only 5 of these can be described y Dirac matrices. Four of these are the 4 known types f pure meson field, and the fifth is the mixed vector and seudoscalar theory. The electromagnetic interaction is nore easily introduced by the projective method than in he 4-dimensional theory. G. J. K.

30.145 3052

On the electric charge current density of a nuclear ystem. PAIS, A. *Physica, 's Grav.*, **9**, 407–21 (*April*, 942).—The projective energy momentum tensor is com- uted for a nuclear system where interactions are des- ribed by the "mixed" meson theory [Abstr. 3051 (1947)]. The longitudinal electromagnetic field and the static neson field are separated from the rest of the Hamil- onian by a canonical transformation, and the trans- ormation of the current vector is discussed in detail. Expressions are given for the electric dipole and quadru- ole moments and the magnetic dipole moment of the ystem. A.

530.145 = 4 3053

On the representation of meson fields in 5-dimensional space. LUBAŃSKI, J. K., AND ROSENFELD, L. *Physica, 's Grav.*, **9**, 117–34 (*Jan.*, 1942) *In French.*—The matrix meson theory is extended from 4 to 5 dimensions. There are then 4 non-trivial irreducible representations of degrees 6, 15 and 10 (2). A 4-dimensional theory is obtained by ignoring one co-ordinate, the 6 and 15 degree representations then reducing to the scalar and pseudovector fields, and the two representations of degree 10 to the same "mixed" theory of Møller and Rosenfeld. Pure pseudoscalar and vector fields are not obtained. Nuclear sources of the fields are defined in terms of Dirac γ-matrices. G. J. K.

530.145 = 3 3054

On free particles with non-vanishing mass and arbitrary spin quantum number. KRAMERS, H. A., BELINFANTE, F. J., AND LUBANSKI, J. K. *Physica, 's Grav.*, **8**, 597–626 (*July*, 1941) *In German.*—The wave equation $(\Gamma^\lambda\partial_\lambda + N\kappa)\psi = 0$ is assumed, where Γ^λ are suitable undors of degree N. It reduces to the Dirac equation for $N = 1$, and the meson equations for $N = 2$. For $N > 2$ it describes particles of masses $N\mu/2\rho$, where $\mu = (\hbar\kappa/c)$ and $\rho = \frac{1}{2}N, \frac{1}{2}N - 1, \ldots, 1$ (or $\frac{1}{2}$). Those of lowest mass μ are the same as those described by the Dirac or Fierz equations with spin $\frac{1}{2}N$. The wave-equation can be derived by a variation method, and a current vector and energy-momentum tensor are uniquely defined, but for $N > 2$ the energy density is not positive definite. G. J. K.

530.145 : 519.4 = 4 3055

On the theory of elementary particles of arbitrary spin. I–II. LUBAŃSKI, J. K. *Physica, 's Grav.*, **9**, 310–38 (*March*, 1942) *In French.*—The details of a proposed theory [Abstr. 3054 (1947)] are discussed. It is shown that the irreducible representations of the Γ^λ are furnished by those of the group of rotations in 5-dimensional space. The representation $D^5_{(r,s)}$ corresponds to a particle with possible mass values $N\mu/2\rho$ where $\mu = (\hbar\kappa/c)$ and $\rho = r, r-1, \ldots 1$ (or $\frac{1}{2}$), and, for given ρ, to possible spin eigenvalues $\sigma = s + (r - \rho), \ldots s - (r - \rho)$. To each value of (ρ, σ) there corresponds a sub-space of the vector-space of the representation $D^5_{(r,s)}$. In Part II the number of such sub-spaces is found. G. J. K.

530.145 = 4 3056

On the spin of elementary particles. LUBAŃSKI, J. K. *Physica, 's Grav.*, **8**, 44–52 (*Jan.*, 1941) *In French.*—In the Fierz theory of particles of high spin s [cf. Abstr. 3054 (1947)], the mean value of $\overline{S}^2$, where S is the spin angular momentum vector, is only Lorentz-invariant for $s > 1$. Thus the equation $\overline{S}^2 = s(s+1)$ is, for $s > 1$, only true in the rest-system of the particle. However $\overline{S}^2 + \overline{A}^2$ is invariant and related to s, where A is the second vector derived from the spin momentum tensor in addition to S. G. J. K.

530.145 = 4 3057

On the quantization of the problem of the interaction of a linear harmonic oscillator with a radiation field. SERPE, J. *Physica, 's Grav.*, **8**, 226–32 (*Feb.*, 1941) *In French.*—Kramer's classical theory of this problem is quantized by the Weisskopf–Wigner method. L. P.

530.145 = 4 3058

Remarks on the radiated meson field. SERPE, J. *Physica, 's Grav.*, **8**, 748–58 (*July*, 1941) *In French.*—A study is made of surface integrals occurring in the expressions for the momentum and angular momentum of a classical neutral vector meson field, which is radiated by a nuclear oscillator of sufficiently high frequency. A formula is obtained analogous to that of Abraham and Sommerfeld in electromagnetism. Only dipole radiation is considered. A.

530.145 = 4 3059

On the non-relativistic approximation in meson theory. SERPE, J. *Physica, 's Grav.*, **10**, 47–8 (*Jan.–Feb.*, 1943) *In French.*—Recoil correction terms to the nuclear interaction, of first order in the meson-nucleon mass ratio (m/M), are given for the Møller–Rosenfeld theory, in addition to terms in (v/c). Part of the correction is analogous to a magnetic interaction term. G. J. K.

530.145 = 4 3060

Various methods of changing the state of a particle of spin 0 or 1. GÉHÉNIAU, J., AND VAN ISACKER, J. *C.R. Acad. Sci., Paris*, **225**, 98–100 (*July* 16, 1947) *In French.*—Interaction terms can be introduced into the reducible meson theory of de Broglie to produce transitions of the mesón between spins 0 and 1. G. J. K.

530.145 : 531.19 = 4 3061

On the calculation of energy levels by the Wentzel–Kramers–Brillouin method and its application to liquid hydrogen. PRIGOGINE, I., AND GARIKIAN, G. *J. Phys. Radium* (*Sér.* 8) **7**, 330–2 (*Nov.*, 1946); *erratum*, **8**, 7 (*Jan.*, 1947) *In French.*—The procedure of evaluation is

carried through for any potential by expanding as a Taylor series. When the method is applied to liquid H, the potential used is that given by the liquid model of Lennard-Jones and Devonshire. G. J. K.

530.145 : 537.122 3062

On the quantisation of electron wave functions. BROER, L. J. F. *Physica, 's Grav.*, **8**, 321–36 (*March*, 1941).—Dirac's equation is derived from a Lagrangian which is quadratic in the gradient. The spinor wave field can be quantized by a method analogous to that introduced by Pauli and Weisskopf for a scalar field. A perturbation treatment is given of the interaction of an electron with the electromagnetic field, which shows that the electron-photon picture seems not to be reconciled with the invariance of the theory. L. P.

530.145 : 537.122 = 4 3063

On the quantization of the system consisting of an electron and the radiation field. OPECHOWSKI, W. *Physica, 's Grav.*, **8**, 161–76 (*Feb.*, 1941) *In French.*—Classical equations have been proposed by Kramers [*Nuovo Cimento*, **15**, 2, 108 (1938)] in which the terms due to the electronic structure are eliminated. These equations are put into canonical form and quantized. They reduce to those of Pauli and Fierz [Abstr. 4076 (1938)] with the approximations assumed by them. G. J. K.

530.145 : 538.3 3064

Quantum electrodynamics and low-energy photons. ELIEZER, C. J. *Proc. Roy. Soc. A*, **191**, 130–3 (*Sept.* 26, 1947).—The probability of certain transition processes involving low-energy photons is investigated on the basis of Dirac's recent method of field quantization. It is shown that the treatment using an expansion in powers of e^2/hc is inconsistent, as it leads to an ∞ value for the probability, when one integrates over a low-energy photon. [See also Abstr. 203–4 (1947)]. A.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.19 : 530.145 = 4 *see Abstr.* 3061

531.252 : 518.3 : 621.317.7 3065

Nomographic representation of the elastic contact conditions between steel pivot and sapphire jewel. TAGG, G. F. *J. Sci. Instrum.*, **24**, 244–8 (*Sept.*, 1947).

531.53 = 4 3066

Oscillations of two isochronous pendulums. SÂLCEANU, C., AND ADAM, S. *C.R. Acad. Sci., Paris*, **225**, 102–4 (*July* 16, 1947) *In French.*

MECHANICAL MEASUREMENTS 531.7

531.717 : 535.34 : 545.824 : 537.531 = 4 *see Abstr.* 3215

531.717.1 : 621.317.39 3067

The automatic Sonigage. ERWIN, W. S., AND RASSWEILER, G. M. *Iron Age*, **160**, 48–55 (*July* 24, 1947).—[Abstr. 2751 B (1947)].

531.717.82 3068

Testing of flatness by the beam comparator method. MARRINER, R., AND JENNINGS, W. O. *Engineer, Lond.*, **184**, 164–5 (*Aug.* 22, 1947).—The beam comparator consists of a robust beam with three feet, the one at the centre of the beam being offset from the line joining the other two. A micrometer gauge is fixed at the centre, and to prevent accidental toppling a fourth spring-loaded foot is adjusted to just clear the surface. The comparator is calibrated by placing it on a reference surface. The instrument is then placed in various directions on the surface under test and the micrometer dial reading noted. The method of testing is explained in detail and a worked example given. The comparator was used for flatness testing of surface plates. W. R.

531.719.28 : 621.317.39 = 4 3069

On the recording of pressures by an apparatus for measuring small displacements at a distance. WALEN, R. *J. Phys. Radium* (*Sér.* 8) **7**, 342–4 (*Nov.*, 1946) *In French.*—[Abstr. 2752 B (1947)].

531.733 : 576.8.095.2 3070

A microrespirometer. GREGG, J. R. *Rev. Sci. Instrum.*, **18**, 514–15 (*July*, 1947).—A simple constant-volume instrument designed for the measurement of gas exchanges of from 0·001 to 0·5 mm³ is described. The results of some measurements of O uptake by minute living organisms are presented, advantages of the design are pointed out, and the possible applications to general microrespirometry are indicated. A.

531.768 : 621.317.39 = 3 3071

The measurement of acceleration by a radio method. LOESER, G. *Z. Instrumkde.*, **64**, 30–46 (*Jan.–March*, 1944) *In German.*—[Abstr. 2753 B (1947)].

531.775 : 621.317.39 3072

Measuring speed with WWV. COE, J. C. *Electronics*, **20**, 90–3 (*Aug.*, 1947).—[Abstr. 2754 B (1947)].

531.775 : 621.317.49 : 621.318.22 3073

Magnetics. "Thermoperm" and magnetic tachometers. *BIOS Rep.* (*No.* 1259) (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 26 *pp.* (1947).—[Abstr. 2780 B (1947)].

531.787.2 : 551.46.018.4 = 5 *see Abstr.* 3380

531.788.13 = 4 3074

Delay of registration of a Knudsen manometer incorporating an oscillatory system. CABRERA, N., AND TERRIEN, J. *Rev. Sci., Paris*, **84**, 224–6 (*Sept.* 1, 1946) *In French.*—A theoretical discussion of the accuracy with which a Knudsen manometer can follow changes in pressure without introducing errors due to its own period of oscillation. It is shown that these will be negligible if the period $<$ a value dependent on the pumping speed; for the usual pumping speeds this $\simeq 1$ sec. Practical considerations make it difficult to construct a Knudsen manometer with a period of < 3 sec, and so other types of instrument are to be preferred when rapid changes of pressure are to be measured. N. C.

MECHANICS OF LIQUIDS 532

532.13 3075

Measurements of the ethylene viscosity at pressures up to 1 000 atm. by the oscillating disc method. GONIKBERG, M. G., AND VERESHCHAGIN, L. E. *C.R. Acad. Sci. URSS*, **55** (*No.* 9) 801–4 (1947).—Values of $\eta \times 10^4$ determined at 24°C at intervals of 100 atm. pressure are: 100, 3·90; 200, 5·50; 300, 6·81; 400, 7·82; 500, 8·62; 600, 9·40; 700, 10·16; 800, 10·94; 900, 11·71; 1 000, 12·43. The apparatus was calibrated by determination of the viscosity of N_2 at 25°C at pressures of 100–400 atm. J. S. G. T.

532.13 : 532.62 = 4 *see Abstr.* 3081

532.13 : 536.48 3076

On the viscosity of liquid helium in the neighbourhood of the lambda-point. KEESOM, W. H., AND KEESOM, P. H. *Commun. K. Onnes Lab. Leiden* (*No.* 260*e*). *Physica, 's Grav.*, **8**, 65–6 (*Jan.*, 1941).—The results of measurements between 2·12 and 2·43°K are given graphically. No discontinuity appears to occur. G. L. W.

532.13 : 541.183.3 = 4 *see Abstr.* 3337

.133 3077

Viscosity data and relations of normal and iso-paraffins. DERBRAGT, G. W., AND BOELHOUWER, J. W. M. *ysica, 's Grav.*, **13**, 305–18 (*Aug.*, 1947).—The vis- ities of seven paraffinic hydrocarbons with 16 or more atoms are derived from the times of descent of a small dle of glass in a capillary filled with the liquid. The ation between viscosity and vapour pressure, length molecule and branching are discussed. A.

2.542 = 82 3078

Helical flow of liquids in pipes with circular cross- tion. PISHKIN, B. A. *Bull. Acad. Sci. URSS, Dep. ch. Sci.* (*No.* 1) 53–60 (1947) *In Russian.*—The ferential equations of current motion are formulated. simplified contemporary theory which assumes equal netic energies of the circular and longitudinal flows is ticized, and a general mathematical treatment of the oblem is presented. A universal nomograph is con- ucted, which yields information on relevant charac- istics such as min. and max. velocities, vector angle tw. longitudinal and total flow and the ratio of netic energies. A. L.

2.59 : 534.12 *see Abstr.* 3094

2.59 : 591.112.3 3079

Waves in elastic tubes: velocity of the pulse wave in large teries. KING, A. L. *J. Appl. Phys.*, **18**, 595–600 (*July*, 947).—An equation for waves in elastic tubes is developed d applied to cylindrical tubes with Hookian and with astomeric walls. The former application yields the foens–Korteweg formula, which has been found adequate. The latter application leads to a rather mplicated equation for the pulse-wave velocity. alues of pulse-wave velocities are computed for the oracic aorta by means of the foregoing equation, and e results are compared with measured mean velocities r the entire aorta. A graphical analysis of this velocity quation can be applied to any large artery; and the ethod is illustrated by computing the pulse-wave elocity in the left common carotid. A.

CAPILLARITY 532.6

532.61 = 4 3080

Law of variation of surface tension with temperature. MEZGER, E. *J. Phys. Radium* (*Sér.* 8) **7**, 303–9 (*Oct.*, 946) *In French.*—An equation is obtained for the varia- ion of surface tension with temp. by making the assump- ion that when substance passes from the interior to the urface of a liquid at the absolute zero of temp., the change of entropy is zero. Use is made of the fact that he surface tension is zero at the critical point, and the educed equation involves the change of internal energy f a molecule passing, at the absolute zero, from the nterior to the surface, the reduced temp., the specific olume and a constant of the nature of a correction term. The constants may be determined from the measured values at two temps. The formula is shown to be accurate within 1% over wide temp. ranges for H_2O, C_6H_6 and Hg. The effect of pressure on the surface tension is also considered and an equation deduced which is compared with the experimental results for CO_2. F. E. H.

532.62 : 532.13 = 4 3081

Limiting thickness of liquid films. Relation between viscosity and the minimum thickness of liquid films. MARCELIN, A. *C.R. Acad. Sci., Paris*, **225**, 225–6 (*July* 28, 1947) *In French.*—A drop of oil, of average viscosity, cannot be compressed between plane surfaces beyond a thickness of 1–2 μ, in general. If the critical pressure at this stage is exceeded the film between the surfaces is suddenly destroyed and the planes attain a state of pseudo-contact with intervening strato-films which behave like a perfect fluid so far as relative motion of the plane surfaces is concerned. Surface irregularities act as a primer to rupture of the film. Stability of the film is increased by an increase of viscosity of the oil and by increased polish of the surfaces. Experiments carried out with six mineral oils of the same origin (viscosities 3·7 to 3 500 stokes) show that the min. thickness of film, prior to rupture under pressure, $\propto \sim$ (viscosity of the oil)$^{\frac{1}{2}}$. J. S. G. T.

532.623 : 539.21 : 548.713 *see Abstr.* 3358

KINETIC THEORY OF LIQUIDS 532.7

MECHANICS OF GASES 533

533.155 3082

An elementary interpretation of the phenomenon of thermal diffusion. CACCIAPUOTI, B. N. *Nuovo Cim.*, **1**, 126–36 (*April*, 1943) *In Italian.*—The method suggested by S. P. Frankel [*Phys. Rev.*, **57**, 661 (*April* 1, 1940)] for an elementary derivation of thermal diffusion is combined with the usual simple kinetic theory procedure. A formula is obtained for the concentration gradient for the case of a gaseous mixture consisting of two types of molecules, regarded as rigid elastic spheres, which differs from the more exact relation by only a numerical factor. S. W.

533.15 3083

Measurements on the thermal diffusion in gas mixtures at low temperatures. VAN ITTERBEEK, A., VAN PAEMEL, O., AND VAN LIERDE, J. *Physica, 's Grav.*, **13**, 231–9 (*May*, 1947).—The gas mixtures investigated were H_2–O_2, H_2–N_2, H_2–CO, H_2–Ne, H_2–He and He–Ne. One reservoir was cooled to liquid air or hydrogen temp.; the other, at room temp., contained an oscillating disc viscometer previously described [Abstr. 3087 (1947)]. The composition of the gas mixture is deduced from its viscosity. H. L.

533.15 = 3 3084

Temperature effects connected with the diffusion in non-moving gases and their applications to measurements. WALDMANN, L. *Z. Phys.*, **124** (*Nos.* 1–2) 2–29 (1947) *In German.*—Extension of the measurements of the non-static diffusion thermo-effect [Abstr. 2803 (1946)]. The thermal diffusion coefficient α and the diffusion constant D are determined for various mixtures of H_2, D_2, N_2, O_2, A, CO_2. Good agreement was found with results obtained by other methods and with the predictions of the theory [Abstr. 401 (1946)]. Some new values of α for mixtures not yet investigated by other methods are given. H. L.

533.15 = 3 3085

The stationary diffusion thermo-effect in streaming gases. WALDMANN, L. *Z. Phys.*, **124** (*Nos.* 1–2) 30–51 (1947) *In German.*—Theory and experiments with H_2/N_2 in greater detail than Abstr. 2802 (1946). Good agreement of the experiments with the theory and with results from the non-static method [Abstr. 3084 (1947)]. H. L.

533.15 = 4 3086

The diffusion thermo-effect. WALDMANN, L. *J. Phys. Radium* (*Sér.* 8) **7**, 129–35 (*May*, 1946) *In French.*—Résumé of Abstr. 401, 2802, 2803 (1946), 3084–5 (1947). H. L.

533.15 : 539.155.2 : 536.46 = 3 *see Abstr.* 3182

533.16 3087

Measurements on the viscosity of gas mixtures. VAN ITTERBEEK, A., VAN PAEMEL, O., AND VAN LIERDE, J. *Physica, 's Grav.*, **13**, 88–96 (*March*, 1947).—These measurements were carried out using the oscillating disc method. At ordinary pressure, mixtures of H_2 with He, Ne, O_2, N_2, and CO were investigated at room temp. and H_2–N_2 also at liquid air temp. Pure H_2, N_2, O_2, A, and He, and the mixtures H_2–N_2 and H_2–A were examined in the Knudsen region. It was found that the law $\eta' = \eta p/(p + c\eta/\sqrt{\rho})$ also applies to gas mixtures. η' = viscosity at pressure p, η = viscosity in the Poiseuille region, c = const. depending on the dimensions of the apparatus, ρ = density of the gas mixture at unit pressure. H. L.

533.5 3088

High vacuum leak testing with the mass spectrometer. WORCESTER, W. G., AND DOUGHTY, E. G. *Trans. Amer. Inst. Elect. Engrs*, **65**, 946–55 (*Suppl. Dec.*, 1946).—Requirements of a leak detector for large all-metal vacuum systems, are fulfilled to a higher degree than hitherto possible by application of a special mass spectrometer. This instrument, which is small, portable and of all metal construction, detects minute quantities of He in samples of gas continuously drawn from the system, portions of which are exposed to a He jet. The design, characteristics and application of the apparatus are described in detail. [See Abstr. 1151 (1947)]. A. M. T.

533.5 : 541.183.56 *see Abstr.* 3341

533.6.011.5 3089

Linearized supersonic flow through ducts. LUDLOFF, H. F., AND REICHE, F. *J. Appl. Phys.*, **18**, 681–2 (*July*, 1947).

533.6.011.5 3090

Rigorous solution of linearized supersonic flow through ducts. MACK, C. E., JR., LUDLOFF, H. F., AND REICHE, F. *J. Appl. Phys.*, **18**, 682 (*July*, 1947).

533.6.013.22 : 536.244 *see Abstr.* 3174

533.6.08 3091

Extended applications of the hot-wire anemometer. CORRSIN, S. *Rev. Sci. Instrum.*, **18**, 469–71 (*July*, 1947).—The use of the hot-wire anemometer has been extended to include the measurement of temp. fluctuation level as well as temp.-velocity correlation in a turbulent flow with heat transfer. Secondly, it can be used for the determination of mean relative conc. in the mixing of two gases of different known thermal characteristics. Finally, the instantaneous response of a hot wire in a turbulent flow with mixing of two gases of different thermal characteristics has been computed. This permits measurement of the conc. fluctuation level as well as the conc.-velocity correlation. A.

KINETIC THEORY OF GASES 533.7

533.7 : 539.132 = 3 3092

The conception of internal temperature in the dynamics of gases with polyatomic molecules. MEIXNER, J. *Z. Phys.*, **124** (*Nos.* 1–2) 129–34 (1947) *In German.*—Discusses the range of application of the phenomenological conception of the internal temp. ascribed to certain degrees of freedom which are not in thermodynamical equilibrium with others. It is found that a single internal temp. can be used if only the ground state and the first excited state are occupied, e.g. in the oscillations of polyatomic molecules at room temp. This is not invalidated by the fact that these states are split into several rotational levels, if the relaxation time for transitions between the latter is short compared with the relaxation time for transitions between the oscillation states. H. L.

VIBRATIONS . ACOUSTICS 534

534.112 = 4 3093

Maintenance of several oscillations on the same wire. JOUTY, R., AND ROCARD, Y. *Rev. Sci., Paris*, **84**, 283–5 (*Sept.* 15, 1946) *In French.*—The experimental set-up employs a steel wire stretched between two knife edges, a "pick-up" electromagnet connected to an amplifier, the output current i of which is passed through the steel wire, a part of which lies in a transverse magnetic field H. The force sustaining oscillations is Hli where l is the length of wire in the transverse field. By suitable adjustment of the relative positions of the "pick-up" magnet and the transverse magnetic field, the author shows how it is easily possible to maintain several oscillations on the wire at the same time. These oscillations may have widely different frequencies (e.g. 1 : 10) and the vibration of higher frequency is not an exact harmonic of that of lower frequency. The theoretical treatment is given, on the lines of weakly coupled circuits, and reference is made to van der Pol's work on valve oscillations with coupling between two oscillating circuits of different frequencies. A. B. W.

534.12 : 532.59 3094

Plane waves in an elastic semi-space covered with a liquid layer. ZVOLINSKY, N. V. *C.R. Acad. Sci. URSS*, **56** (*No.* 1) 19–22 (1947).—General solutions are obtained for this 2-dimensional problem with a non-viscous fluid. Potentials of the form $f(t + \theta x, y)$ are assumed, where x and y are measured $\parallel$ and $\perp$ to the interface, respectively. $(1/\theta)$ is a constant $>$ the velocity of transverse waves in the solid, which, in turn, is assumed $>$ the velocity of waves through the liquid. G. J. K.

534.13 : 539.501 *see Abstr.* 3327

534.213 : 550.341 3095

The range of existence of Rayleigh and Stoneley waves. SCHOLTE, J. G. *Mon. Not. R. Astr. Soc., Geophys. Suppl.*, **5** (*No.* 5) 120–6 (1947).—The boundary curves of simple Stoneley waves are evaluated and their range of existence in a superficial layer is determined. Except where the thickness of the layer is small compared with the length of transverse waves, the range of existence of generalized Rayleigh and Stoneley wave systems can be approximated by calculating the asymptotes of the boundary curves. These asymptotes are determined by the simple Stoneley boundary curves and by the period equation of the waves in an isolated layer. A. HU.

534.231 : 621.395.623.52 3096

The design of acoustic exponential horns. Data sheets on horns of square and circular cross section. *Electronic Engng*, **19**, 286–7 (*Sept.*, 1947).

534.241 3097

A theory of underwater reverberation due to sound scattering. SUHAREVSKY, G. M. *C.R. Acad. Sci. URSS*, **55** (*No.* 9) 813–16 (1947).—Three idealized cases are considered. It is shown that the reverberation intensity is inversely proportional to the second, third or fifth power of the time according as whether the medium is unbounded and uniformly scattering, unbounded with a plane scattering layer or semi-bounded with a plane scattering boundary. [See Abstr. 256 (1947)]. G. F. H.

534.321.9 : 548.0 : 539.32 *see Abstr.* 3326

534.414 = 5 3098

Effect of viscosity and of terminal conductance in an acoustic resonator. BARDUCCI, I. *Atti. Accad. Naz.*

i, 1 (*No.* 6) 764 (1946) *In Italian.*—The paper is an sion of the theory of the Helmholtz resonator having indrical neck of circular section. Consideration is to the effects of kinematic viscosity and of the stic impedance due to the radiation (including tive acoustic resistance and mass). A corrected of the frequency and resonance coefficient of the nator is given. A. B. W.

14 : 612.858.71 *see Abstr.* 3391

512.2 : 621.395.616 = 3 3099

easurement of smallest sound pressures with the enser microphone. WEYMANN, G. *Elekt. Nachr.-. [ENT]* 20, 149–58 (*June*, 1943) *In German.*—The r deals with the theoretical calculation of the static dynamic characteristics of the condenser microne. An estimate is made, based on these physical acteristics, of the theoretical sensitivity. It is shown the upper limit of sensitivity is sufficient to make ible a measurement of molecular noise, the estimated nd pressure at this limit being $\sim 2\times10^{-4}$ dyne/cm². A. B. W.

83.08 = 4 3100

leasurement of noise and of acoustic insulation. SZYNSKI, G. *Ann. Télécommun.*, 2, 29–36 (*Jan.*, 7) *In French.*—The "objective" method is discussed a suitable measuring instrument described. The ception of "subjective" acoustic insulation is introed, and a new unit for its measurement is proposed. G. F. H.

OPTICS . RADIATION . SPECTRA 535

.072 : 535.338.334 : 537.531 *see Abstr.* 3213

5.135 : 535.314 3101

Refraction of plane non-uniform electromagnetic waves ween absorbing media. PINCHERLE, L. *Phys. Rev.*, 72, 2–5 (*Aug.* 1, 1947). (*See also Nuovo Cim.*, 3, 328–37 *ct.*, 1946) *In Italian*).—When a plane non-uniform ctromagnetic wave is refracted between two conducting dia, there are two possible positions for the propaga- n vector in the second medium. Consideration of the rgy flow shows that each solution holds within a tain range of values of the (complex) angle of incidence, transition from one to the other occurring in a continuous way. The two cases of the electric vector and ‖ to the plane of incidence are discussed. A.

5.23.08 : 537.324 3102

The design of fast thermopiles and the ultimate sensiity of thermal detectors. HORNIG, D. F., AND KEEFE, B. J. *Rev. Sci. Instrum.*, 18, 474–82 (*July*, 47).—The design of max. sensitivity thermopiles is idied with special reference to their use with interpted radiation in i.r. spectroscopy. The conventional nstruction is shown to have advantages over evaporated ermopiles as the heat capacity of short fine wires can made ≫ that of the receiver. If Johnson noise is the ain noise factor the min. detectable power $\propto 1/S = /E$ (S = absolute sensitivity, E = voltage sensitivity, = thermopile resistance). A factor of merit is deed for thermo-electric materials. Relations for the ne const. are obtained, response times of <0·02 sec ing practicable, and good performance obtainable at 10 c/s interruption frequency. At 300° K the limit of nsitivity of a detector of 0·5 mm² area and 1 c/s bandidth is shown to be 4×10^{-12} W. A.

535.23.08 : 615.831.7 3103

New meters employing light-sensitive cells for the measurement of erythemal energy. KERR, G. P. *Rev. Sci. Instrum.*, 18, 472–3 (*July*, 1947).

535.234 : 536.5.081.4 = 5 *see Abstr.* 3187

535.24 3104

The luminometer. *FIAT Rep.* (*No.* 871) (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 5 *pp.* (1947).—Describes a photometer for the measurement of low brightness. The size of the field is ~30° and the dia. of the eyepiece aperture 9 mm. The adjustment is by a photometric wedge. The lower limit is 10^{-6} millilambert. [The constructional diagram is missing and the curves in Fig. 2 are wrongly described in the legend.] J. W. T. W.

535.241 : 389.6 : 621.383 : 621.317.39 3105

Photo-electric exposure meters. *Brit. Stand.* (*No.* 1383) 14 *pp.* (1947).—[Abstr. 2756 B (1947)].

535.242.43 : 771.534.56 : 522.617.2 *see Abstr.* 3008

535.243 : 535.341 3106

Transmission measurements with the Beckman quartz spectrophotometer. GIBSON, K. S., AND BALCOM, M. M. *J. Opt. Soc. Amer.*, 37, 593–608 (*Aug.*, 1947). *J. Res. Nat. Bur. Stand., Wash.*, 38, 601–16 (*June*, 1947).—Essential features of the instrument are described, including a const.-temp. enclosure (for samples). Various instrumental characteristics are noted and possible errors discussed, particularly those that may be present in the measurement of polarizing samples. Wavelength calibrations are shown for two instruments. A detailed over-all check of the reliability of data obtained by means of glass standards of spectral transmittance shows it to give results over the wavelength range from 390 to 750 mμ fully as reliable as those obtained with other spectrophotometers, if various precautions are taken. A.

535.31 : 537.363 = 4 3107

On a new method for obtaining the curve of refractive index gradient for an optical medium. WALEN, R. J. *J. Phys. Radium* (*Sér.* 8) 7, 271–80 (*Sept.*, 1946) *In French.*—The tube containing a liquid in an apparatus such as that used for electrophoresis shows a vertical gradient of refractive index. The tube is illuminated by parallel light, which after passing through the tube is focused on a screen. An optical plate X is placed immediately in front of the tube, so designed that light passing through different horizontal planes of the tube is brought to focus at different places on a horizontal line, the relation between the height of a given plane and the horizontal displacement of the corresponding image being linear. Any vertical variation of index in the liquid in the tube results in a vertical displacement of each image point. The curve of gradient of refracted index is thus traced on the screen. X has the form of a "multiple helicoidal lens," the size and number of the components being determined as a compromise giving as much light as possible, while avoiding disturbing diffraction effects. Details are given of the geometrical aberration of the system, and of methods for producing the plates. H. H. HOP.

535.314 : 535.135 *see Abstr.* 3101

535.317 3108

Note on aplanatic lenses for unit magnification. SMITH, T. *Proc. Phys. Soc., Lond.*, 59, 844–6 (*Sept.*, 1947).—Erratum: in Abstr. 1806 (1947) line 2, *for* 323–5 (*March*, 1947) *read* 844–6 (*Sept.*, 1947).

535.317.9 3109

Erratum: On the theory and computation of an aspherical surface. GLANCY, A. E. *J. Opt. Soc. Amer.*, 37, 663 (*Aug.*, 1947).—See Abstr. 2826 (1946).

535.317.9 : 522.21 3110

An improved type of Schmidt camera. HAWKINS, D. G., AND LINFOOT, E. H. *Mon. Not. R. Astr. Soc.*, **105** (*No.* 6) 334–44 (1945).—The aspheric Schmidt plate is replaced by a combination of an aspheric plate and a meniscus lens. The resulting system at $f/1{\cdot}2$ is superior when achromatized both to the Schmidt camera and to the Maksutov system. An analysis is made of the off-axis errors of the proposed camera. A. HU.

535.32 3111

Refractive index and Lorentz–Lorenz function of nitrogen up to 2 000 atmospheres at 25° C. MICHELS, A., LEBESQUE, H. AND L., AND DE GROOT, S. R. *Physica, 's Grav.*, **13**, 337–43 (*Aug.*, 1947).—Results are given for wavelengths of 6 678, 5 876, 5 016, 4 922, 4 713 and 4 471 Å. The Lorentz–Lorenz function first increases slightly with pressure, and after passing through a flat maximum decreases. A.

535.32 : 535.436 *see Abstr.* 3157

535.322 3112

An instrument for the measurement of the index of refraction of liquids in the wave-length range 200 mμ to 1 000 mμ. LAUER, J. L., AND MILLER, P. H., JR. *J. Opt. Soc. Amer.*, **37**, 664–8 (*Aug.*, 1947).—An instrument which can be used from 200 to 1 000 mμ with transparent liquids for the determination of the refractive index relative to air with an error of $\pm 0{\cdot}0002$ is described. A cell consisting of two quartz plates and an air space is rotated in the liquid through which is passing a parallel monochromatic beam of light, and the critical angle at the quartz/air interface is determined. The instrument in its present form is particularly adapted for use with a Beckman Model DU quartz spectrophotometer. Results for water and *n*-hexane are given as examples. A.

535.33 : 537.531 *see Abstr.* 3214

535.33 : 545.82 *see Abstr.* 3340

535.33 : 771.448.1 : 535.89 *see Abstr.* 3170

535.331 3113

The relative transition probabilities in the spectrum of magnesium. KERSTEN, J. A. H., AND ORNSTEIN, L. S. *Physica, 's Grav.*, **8**, 1124–36 (*Dec.*, 1941).—Intensities of lines in the Mg spectrum have been measured in arcs (a.c. and d.c.), the temps. of the arcs being measured spectroscopically. Excitation appears to be thermal, and the relative transition probabilities are calculated; the products of the transition probability and statistical weight of the initial level are tabulated for a number of triplet and singlet lines. Intensity ratios of components of triplets, where measured, agree with predictions from the sum rule. A. G. G.

535.332–15 3114

Infrared emission spectra of krypton and argon. HUMPHREYS, C. J., AND PLYLER, E. K. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 499–503 (*May*, 1947).—The analysis of the spectra of the noble atmospheric gases, utilizing descriptive data covering the photographically accessible region, has long indicated the possibility of a considerable extension of most of these spectra into the infrared region beyond $1{\cdot}3$ microns. Observations have been made in the region between 1 and 2 microns. More than 15 new lines of Kr have been observed. Part of these are blends of unresolved pairs or groups. The emission maxima have been determined in favourable cases to a precision of two wave numbers. All observed lines have been classified, the most intense being represented by combinations of the type $2p$–$3d$. Two new levels from the configuration s^2p^5f have been found. The remaining unobserved combinations of the type $1s$–$2p$, occurring in this region, are, with one exception, too weak to b observed. The A infrared spectrum was observed b Paschen. More of its predicted combinations are in th photographic region than in the case of Kr. A few line near $1{\cdot}4$ microns have been observed.

535.338 = 3 311

The spectrum of CuH excited in a hollow cathod REINEBECK, L. *Z. Naturforsch.*, **2a**, 251–9 (*May*, 194 *In German.*—Experiments suggest that anomalou distributions of CuH molecules among rotational state (not shown by CuD) arise from the excitation proce rather than from predissociation. R. F. I

535.338 : 523.87 *see Abstr.* 3034

535.338.33 311

Line breadths and Voigt profiles. VAN DE HULST, H. C AND REESINK, J. J. M. *Astrophys. J.*, **106**, 121–7 (*Jul* 1947).—Voigt functions are useful approximations fo the intensity distribution in spectral lines. A table o these functions is given, and its use in computations o instrumental distortion is explained. Some math matical properties of the Voigt functions are mentioned.

535.338.334 = 4 311

Superposition of several light distributions. Applicatio to broadening of lines by successive reflection. ROIG, J AND GOBERT, J. *J. Phys. Radium* (*Sér.* 8) **7**, 359–62 (*Dec* 1946) *In French.*—Theoretical demonstration that th widening of a spectral line by reflection is negligible fo most purposes, e.g. $0{\cdot}0024$ Å for the Cd line at 6 438 Å. N. C

535.338.334 : 535.072 : 537.531 *see Abstr.* 3213

535.338.334 : 537.228.5 : 537.523.4 *see Abstr.* 3207

535.338.4 = 3 311

Rotational analysis of bands of the ε-system of the N molecule. GERÖ, L., SCHMID, R., AND VON SZILY, F. K *Physica, 's Grav.*, **11**, 144–50 (*March*, 1944) *In German.*— From a study of the 0,2, 0,3 and 0,4 bands the value o B_0' for the upper $D^2\Sigma^+$ state was found to be $1{\cdot}991_7$ cm^{-1} [see Abstr. 1793 (1944)]. R. F. I

535.338.4 = 4 311

Emission spectrum of carbon monoxide following atom recombination. HERMAN, L., AND HERMAN, R. *C. Acad. Sci., Paris*, **225**, 230–2 (*July* 28, 1947) *In French.*— Wavelengths of a number of new band-heads of th triplet band-system ($d^3\Pi \rightarrow a^3\Pi$) are given. R. F. I

535.338.4 : 536.55 312

Intensity profiles of non-resolved CN bands. SMI MIESSEN, M. M., AND SPIER, J. L. *Physica, 's Grav.*, 9 193–212 (*Feb.*, 1942).—Methods of measuring temps especially of arcs, using the band spectrum of CN a examined. With low-dispersion prism-spectrograph temps. can be determined from the intensity profiles o the bands. These are computed from theoretical in tensity relationships for the (0,0) and (1,1) bands fo several temps. and instrumental line-breadths; results ar shown graphically. See also Abstr. 2489 (1947). A. G. G

535.338.4 : 536.55 312

On the determination of the temperature [of arcs] wit the aid of non-resolved CN bands 3 883 and 3 871 Å SPIER, J. L., AND SMIT-MIESSEN, M. M. *Physica, 's Grav* **9**, 422–32 (*April*, 1942).—Continuing work described i Abstr. 3120 and 2489 (1947), more convenient but les complete criteria for determining temps. from intensit profiles are examined. These are by comparisons o (*a*) areas of band profiles, (*b*) top intensities of bands (*c*) slopes of the backs of the intensity profiles of bands. A. G. G

338.4 : 536.55 3122

emperature determination from the CN bands 4 216 4 197 Å in the case of non-resolved rotational structure. R, J. L., AND SMIT, J. A. *Physica, 's Grav.*, **9**, 597–608 *v*, 1942).—A similar treatment to that described in ir. 3120 (1947) but for the (0,1) and (1,2) bands. A. G. G.

338.4 : 536.55 = 4 3123

emperature measurements using the rotational lines of . COHEUR, P. *Physica, 's Grav.*, **8**, 1075–6 (*Nov.*, l) *In French.*—In arcs and sparks between Al elec- les the rotational temp. of the AlO bands is always .000°, even though that measured from CN bands be 6 500°. The excitation of AlO is probably due special process, and is not thermal. [See Abstr. 1576 16)]. A. G. G.

.34 : 523.87 *see Abstr.* 3035

.34 : 545.824 : 531.717 : 537.531 = 4 *see Abstr.* 3215

.341 : 535.243 *see Abstr.* 3106

.343 : 537.531 = 4 *see Abstr.* 3216

.343.1 : 523.872 *see Abstr.* 3037

.343–15 : 539.13 = 4 *see Abstr.* 3270

.343.2 3124

The absorption spectra of zinc sulphide and willemite. SOLF, J. H., DE GROOT, W., AND KRÖGER, F. A. *ysica, 's Grav.*, **8**, 805–9 (*July*, 1941).—Discussion of a reported by various authors, with some new measure- nts by Gisolf on ZnS . Cu. S. T. H.

5.343.2–15 : 548.7 : 539.133 = 4 3125

Absorption of polarised infra-red radiation by crystals l the structure and binding of H_2O and OH groups: I. UISFERT, J. *J. Phys. Radium* (*Sér.* 8) **8**, 21–8 (*Jan.*, 47) *In French.*—Details of the absorption spectra in the nge 0·9 to 2·3 μ of 12 crystals (silicates and sulphates) different orientations with respect to the plane of larization of the incident radiation are given. R. F. B.

5.343.2–32 3126

The absorption of gold and silver in the vacuum- raviolet region. SIMONS, C. F. E. *Physica, 's Grav.*, **10**, 1–66 (*March*, 1943).—The absorption spectra of tallic Au and Ag have been examined in the region 800–1 100 Å. Observed bands are assigned to transitions *p*, *d*–*p* and *d*–*s*, the last being responsible for the main sorption by Au at 3 300 Å. A diagram of the electronic nds of Au is given. In the metal, as in the free atom, e *d*-electrons of Ag are more firmly bound than those Au; this agrees with the chemical properties. A. G. G.

35.343.3 : 539.133 = 4 *see Abstr.* 3276

35.343.3–32 3127

The absorption spectra of benzene derivatives in the cuum ultra-violet. I. PRICE, W. C., AND WALSH, A. D. *roc. Roy. Soc. A*, **191**, 22–31 (*Sept.* 26, 1947).—New hotographs of the far u.v. spectrum of benzene are resented. The absorption from 2 000 to 1 800 Å λ_{max}, ~ 1 980 Å) is regarded not as a part of the much ronger absorption of peak at 1 790 Å but as due to a eparate transition. Sharp bands lying at 1 790 Å epresent the first member of a previously reported ydberg series. The spectra of toluene, xylene, nonochloro- and *o*-dichlorobenzene, bromobenzene, odobenzene and pyridine are briefly described, and the hifts relative to benzene are discussed. Two Rydberg erics were observed for toluene, converging to a first onization potential of 8·77 ± 0·05 V. A.

35.343.3–32 3128

The absorption spectra of benzene derivatives in the acuum ultra-violet. II. WALSH, A. D. *Proc. Roy. Soc. A*, **191**, 32–8 (*Sept.* 26, 1947).—The far u.v. spectra of styrene, α-methyl styrene, phenyl acetylene, phenyl cyanide and phenyl isocyanate are described. Many of the observed regions of absorption are correlated with those of the benzene spectrum. With increasing conjugation of the side chain with the ring, the benzene 1 980 Å absorption moves much farther to long wavelengths than do the benzene 2 600 and 1 790 Å absorptions. α-methyl styrene shows a shift to the violet of certain regions of its spectrum relative to styrene. Phenyl isocyanate has a spectrum much closer to that of benzene than have the other molecules discussed. A.

535.343.3–31 = 3 3129

Regularities in the spectra of substituted benzenes. FÖRSTER, T. *Z. Naturforsch.*, **2a**, 149–53 (*March*, 1947) *In German.*—Wave-mechanical arguments are used to interpret frequencies and intensities of ultra-violet absorption bands. R. F. B.

535.343.32 3130

The absorption of praseodymium in solutions. WOUDENBERG, J. P. M. *Physica, 's Grav.*, **9**, 217–24 (*Feb.*); *erratum*, 936 (*Nov.*, 1942)—Intensities of $PrCl_3$ absorption bands in aqueous solution at λ4440, 4688, 4819 and 5930 have been measured; they correspond to 2·92, 0·84, 0·42 and $0{\cdot}76\times10^{-6}$ classical oscillations per Pr^{---}ion respectively. The intensities of the first three are not proportional to the statistical weights of the excited levels (5 : 3 : 1). A. G. G.

535.343.4 = 4 3131

Researches on the absorption spectrum of SeO_2. DUCHESNE, J., AND ROSEN, B. *Physica, 's Grav.*, **8**, 540–54 (*June*, 1941) *In French.*—An experimental study at various pressures and temps. All the bands in the middle ultraviolet can be ordered in a single system $\nu = 33\,330 + 665v' - 1{\cdot}5v'^2 - 900v''$. L. P.

535.343.4–14 : 539.133 : 539.152.2 3132

Nuclear quadrupole moment effects in the inversion spectrum of ammonia. WATTS, R. J., AND WILLIAMS, D. *Phys. Rev.*, **72**, 263–5 (*Aug.* 15, 1947).—Satellite lines have been observed near lines 11, 22, 21, 33, 44, 55, 66, and 76. Their relative intensities and displacements are in excellent agreement with Van Vleck's recent theory. From the observed separations from the main lines can be calculated the interaction energy between the electrical quadrupole moment of the N nucleus and the electric field of the NH_3 molecule. A.

535.343.4–14 : 539.133 : 539.152.2 3133

Analysis of the hyperfine structure in the microwave spectrum of the symmetric top molecule CH_3I. GORDY, W., SMITH, A. G., AND SIMMONS, J. W. *Phys. Rev.*, **72**, 249–50 (*Aug.* 1, 1947).—A complete analysis of this spectrum leads to the following results: (*a*) the spin of I is 5/2; (*b*) its quadrupole moment is negative; (*c*) the coupling coefficient of 1 520 ± 15 Mc/s for CH_3I differs from the value 2 070 ± 20 Mc/s for ICN, indicating a difference in the C–I bond in the two molecules. W. E. D.

535.343.4–14 : 539.133 : 539.152.2 3134

Millimeter-wave spectra: hyperfine structure of BrCN and ICN. GORDY, W., SMITH, W. V., SMITH, A. G., AND RING, H. *Phys. Rev.*, **72**, 259–60 (*Aug.* 1, 1947).—The bond length is increased in the excited vibrational state by 0·17% for Br–C and by 0·18% for I–C. The I–C bond length in the ground state is deduced to be 2·00 Å. The spin of I is found to be 5/2 and the quadrupole coupling factors are: Br^{79}, 670 ± 15; Br^{81}, 567 ± 15; I^{127}, 2 070 ± 20 Mc/s. W. E. D.

535.343.4–15 : 539.133 3135

The infra-red spectrum and molecular constants of $C^{12}O^{16}$ and $C^{13}O^{16}$. LAGEMANN, R. T., NIELSEN, A. H.,

AND DICKEY, F. P. *Phys. Rev.*, **72**, 284–9 (*Aug.* 15, 1947). —The spectrum has been investigated with a 7 200 line-per-inch grating. The fundamental bands of $C^{12}O^{16}$ and $C^{13}O^{16}$ and the overtone of $C^{12}O^{16}$ were measured. The rotational structure has been analysed by means of combination relations, and the following new values of the molecular constants have been obtained: $\omega_e = 2\,169{\cdot}60$, $\omega'_e = 2\,121{\cdot}33$, $x_e\omega_e = 13{\cdot}22$, $(x_e\omega_e)' = 12{\cdot}64$, $B_e = 1{\cdot}9238$, $B'_e = 1{\cdot}8465$, $\alpha = 0{\cdot}0175$, $\alpha' = 0{\cdot}0169\ cm^{-1}$, $I_e = 14{\cdot}548 \times 10^{-40}$, $I'_e = 15{\cdot}157 \times 10^{-40}\ g\ cm^2$, r_e (average for both molecules) $= 1{\cdot}1291 \times 10^{-8}$ cm. The primed constants refer to the isotopic molecule. A.

535.345.6 3136

Filters for the isolation of the 3 130 Å spectral group of the mercury arc. HUNT, R. E., AND DAVIS, W., JR. *J. Amer. Chem. Soc.*, **69**, 1415–18 (*June*, 1947).—A critical examination of filters commonly used has shown that (*a*) cobaltous chloride is of doubtful value, and (*b*) combining 50 mm of 0·178 M Ni chloride, 50 mm of 0·0005 M K chromate, 10 mm of 0·0245 M KH phthalate, and 5 mm of Red Purple Corex glass (Corning No. 9863) reduces extraneous u.v. to <0·01%, whilst ~25% of the group is transmitted. In a high pressure arc the above filters restrict the radiation to the 3 100–3 300 Å region. W. R. A.

535.345.6 3137

Infra-red filters and cells of unpolished salt crystals. MCGOVERN, J. J., AND FRIEDEL, R. A. *J. Opt. Soc. Amer.*, **37**, 660–3 (*Aug.*, 1947).—Transmission characteristics of NaCl and KBr plates, ground with various abrasives or etched by a solvent, have been investigated between 2 and 25 microns for use as infra-red filters and absorption cell windows. Low transmissions are obtainable with these plates in the high energy region of the blackbody maximum without appreciable decrease in their transparency at longer wavelengths. Simple, dry grinding with the finer abrasives produces windows for absorption cells, which, in spite of visible scratches, are as transparent in the infra-red as windows tediously prepared on the usual pitch or cloth lap. A.

535.37 3138

Luminescence of cerium compounds. KRÖGER, F. A., AND BAKKER, J. *Physica, 's Grav.*, **8**, 628–46 (*July*, 1941).—The cerous ion, but not the ceric, shows luminescence to short ultra-violet, mostly with emission in the near ultra-violet. Absorption and emission bands are figured and described for sulphates, fluorides and other salts of Ce, and for combinations with the salts of K, Th, La, Al, Ca, Sr, etc. The strongest part of each emission spectrum shows two small peaks separated by ~1 900 cm^{-1}, attributed to the separation in the fundamental doublet state $^2F_{5/2}$, $^2F_{7/2}$. Absorption bands are due to transitions from the former level. As expected for transitions within the Ce^{+++} ion, exponential decay is found for a number of these materials. S. T. H.

535.37 3139

On the after-glow of sodium chloride and its decay. BOSE, H. N. *Indian J. Phys.*, **21**, 29–42 (*Feb.*, 1947).—The decay of luminescence after-glow excited by X-rays has been investigated in the case of a single crystal, a pressed powder sample and a sample with 0·1% of Cu. The effect of annealing the pressed samples at different temps. as well as of heating the sample during emission has also been studied. The suitability of various mechanisms and the corresponding decay laws is discussed. The ideas of trap mechanism as developed by Randall and Wilkins have been utilized to deduce the expected decay law in the present case. A.

535.37 = 3 314(

On the fluorescence of fluorite and the divalent rar earths. PRZIBRAM, K. *C.R. Acad. Sci. URSS*, **56** (*No.* 1 31–3 (1947) *In German.*—Radiophotoluminescence, o luminescence under ultra-violet or visible light followin exposure of the substance to radium radiations, is show by fluorite and other salts. Emission at normal temp occurs for the activators Eu (blue band) and Sm (red) at low temp. for Yb (yellow-green) and Tu (red). It i considered that these activators must be in the divalen state. The Eu band may also be produced by flam excitation. S. T. H

535.37 = 945.11 314

Luminescent materials. SZIGETI, G. *Elektrotechnika* **39**, 70–3 (*April*); 81–6 (*May*, 1947) *In Hungarian.*— A review of the most important applications of th various materials and of current theories on the lumines cence of crystalline solids. An account is given of th author's work on the emission spectra and temp. dependence of the luminescence of Mn-activated Zn an Zn–Be silicates. A

535.371 = 3 314

On quenching of phosphorescence. IV. Variation of th exciting radiation. BECKER, F. *Z. Naturforsch.*, **2a** 100–8 (*Feb.*, 1947) *In German.*—A systematic study o the destruction by infra-red of the phosphorescenc excited in ZnS . Cu and in ZnS . CdS . Ag by light X-rays, cathode rays and α-rays. Very considerable differences are found. Possible explanations are discussed. J. E.

535.371 = 3 314

Comment on complex phosphors. BRAUER, P. *Z Naturforsch.*, **2a**, 238–9 (*April*, 1947) *In German.*—The author's work [Abstr. 2843 (1946)] is now considered t show that absorption of light of long wavelength no only liberates trapped electrons in phosphors such a SrS . EuSm, but also causes relative changes in the average degree of ionization of the different activato atoms present. S. T. H.

535.371 : 545.828 = 3 3144

Changes of luminescence produced by oxygen. Detection of traces of oxygen. KAUTSKY, H., AND MÜLLER, G. O. *Z. Naturforsch.*, **2a**, 167–72 (*March*, 1947) *In German.*—Very small traces of oxygen may have two effects on the long-duration phosphorescence of adsorbed dyestuffs: (*a*) an extinction effect (followed by regeneration); (*b*) a transformation at low temp. of the colour from that characteristic of the low temp. phosphorescence to that of the normal temp. fluorescence. These effects are sensitive to a pressure of 5×10^{-4} mm Hg in the first case and 5×10^{-6} in the second case, and can be used quantitatively. Explanations are offered in terms of resonance coupling between molecules of dyestuff excited to a metastable (phosphorescent) state, leading to excitation of one dyestuff molecule to the higher fluorescent state and simultaneously to the excitation of an oxygen molecule. J. E.

535.371.07 = 4 3145

Considerations on the maximum efficiency of fluorescent screens under X-rays. PETRESCU, V., AND LUCA, E. *Bull. École Polyt. Jassy*, **2**, 193–202 (*Jan.–June*, 1947) *In French.*—The ratio of fluorescent screen brightness to incident X-radiation shows a max. as tube potential is increased. With increasing thicknesses of Al or Cu filters in the beam the max. shifts to higher kV values, and the efficiency ratio increases. S. T. H.

.375.54 = 4 3146

:aman spectra of the internal vibrations of anhydrite. JTURE, L. *C.R. Acad. Sci., Paris*, **225**, 185–6 (*July* 21, 7) *In French.*—Symmetry types are given for the 9 :rnal frequencies of crystalline $CaSO_4$, which fall into roups, each corresponding to one frequency of the : SO_4^{--} ion. Relative intensities and frequency erences within each group are discussed in terms of turbation by neighbouring Ca++ ions. L. A. W.

.375.55 = 5 3147

)n a possible low frequency Raman effect in liquid CCl_4. ULOTTO, L. *Nuovo Cim.*, **1**, 440–4 (*Dec.*, 1946) *In lian.*—Qualitative and quantitative observations on . Raman spectrum of CCl_4 have shown no residual :cts between 15 and 100 cm^{-1} when normal optical ttering is allowed for. Raman effects in this low quency range are therefore attributed to molecular ations or angular vibrations in liquids having mole- ar anisotropy, CCl_4 being perfectly isotropic. Thallium liation was used for excitation. S. T. H.

5.39 3148

Theoretical considerations concerning the reduction of tical reflection losses by means of a transition layer. EYSING, N. J. *Physica,'s Grav.*, **8**, 687–94 (*July*, 1941).— theoretical study is made of the general formula for flection at glass surfaces, in connection with the minution of the loss of light by "blooming" and other ocesses. Special cases studied include those where posited layers have a varying refractive index. A. H.

5.39 3149

The reflection of light from glass with double and multiple ms. VAŠIČEK, A. *J. Opt. Soc. Amer.*, **37**, 623–34 lug., 1947).—The reflection of light from a thin film a glass, that is, from 2 boundary surfaces, can be terpreted as a reflection from a single surface of a ypothetical medium. Similarly, the reflection from thin films on glass, that is, from 3 boundaries, can be duced to the case of a single film which in turn can be duced to the reflection from a single surface. This ocess can be carried out for any number of thin films n glass. The normal incidence problem is considered r one, two and several films and limiting cases of terest in optical practice are calculated. The reflection rmulae are simplified if multiple reflections in the films e disregarded. In conclusion, the results for 2 thin lms on glass are given. These may be used in practice decrease or completely extinguish reflection, as well as increase it. A.

535.39 = 4 3150

Energy dissipation in an absorbent sheet. ARZELIÈS, H. *C.R. Acad. Sci., Paris*, **225**, 111–12 (*July* 16, 1947) *In French.*—Slight extension of the mathematical treatment reported earlier. [See Abstr. 2113 (1947)]. A. H.

535.39 = 4 3151

Increasing reflection coefficients by means of a protective ayer. PERROT, M. *Rev. Opt. (Théor. Instrum.)* **26**, 202–4 *July–Aug.*, 1947) *In French.*—A graphical construction is given for the reflection coefficient of a metallic surface coated with a transparent film. Such a thin transparent protective film can increase the reflection coefficient of the metal. Thus for $\lambda = 0{\cdot}486\ \mu$ the reflection coefficient of Al can be increased from 65% to 80% by means of a thin deposit of TiO_2. The effect shows a strong dependence upon wavelength. H. H. HOP.

535.39 : 535.824.3 *see Abstr.* 3169

535.393 3152

The variation of the reflectivity of nickel with temperature. WEIL, R. *Proc. Phys. Soc., Lond.*, **59**, 781–91 (*Sept.*, 1947).—A new method of measurement, employing multiple reflection from mirrors is described. The novel method of polishing the mirrors, and the construction of the vacuum furnace are outlined. The results [summarized in Abstr. 304 (1947) in which the second figure quoted should read "blue"] are given in a graph, and correlated with those of earlier workers. A.

535.393 : 535.87 3153

The reflectivity of speculum metal. TOLANSKY, S., AND DONALDSON, W. K. *J. Sci. Instrum.*, **24**, 248–9 (*Sept.*, 1947).—The reflectivities of electro-deposited speculum (Cu–Sn alloy containing preferably 45% of Sn) and of speculum prepared by evaporation *in vacuo* have been determined over the range 4 500–6 500 Å. The reflectivity of the freshly polished electro-deposited alloy varies from 63% at 4 500 Å to 75% at 6 500 Å. After keeping for six months in a damp atmosphere the reflectivity decreases by 10% in the red region and by 2% in the blue region. Evaporated speculum on a glass base has a reflectivity of 68% at 4 500 Å, increasing to 78% at 6 500 Å. The higher reflectivity of evaporated speculum as compared with electro-deposited speculum of the same composition is attributed to the greater perfection of the evaporated mirror surface and consequent reduction in the amount of non-specular reflection. A.

535.42 : 535.82 *see Abstr.* 3167

535.42 : 548.73 : 537.531 *see Abstr.* 3217

535.42 : 612.843.63 = 5 3154

On the resolution of rectangular diaphragms [centriche rettangolari]. BENEDETTI, M. *Ric. Sci. Ricostruz.*, **15**, 548–9 (*Dec.*, 1945) *In Italian.*—Observing two 0·43 mm dia. holes, one 0·97 mm above the other, illuminated by a monochromator ($\lambda = 6\times10^{-5}$ cm), with the naked eye through a rectangular diaphragm of vertical opening 0·10, 0·15 . . . 0·40 mm (D), horizontal variable continuously (h) (0–0·3 mm), resolving power is obtained and graphed as function of h for various D values. The λ/D rule does not hold. Max. r.p. occurs at slightly increasing h values with increasing D. J. A. W.

535.43 = 4 3155

Coherent scattering and the corpuscular microscope. DE BROGLIE, L. *C.R. Acad. Sci., Paris*, **224**, 1743–4 (*June* 25, 1947) *In French.*—It has already been shown that it will never be possible to see the structure of an atom by a mechanism based on Compton scattering with change of frequency. The present note shows that as the wavelength of the incident beam becomes short enough to resolve atomic details the coherent scattering reduces to a negligible intensity; this mechanism is therefore also useless. A. H. W. B.

535.434 3156

The effect of atmospheric scattering upon the appearance of a dark object against a sky background. FRY, G. A., BRIDGMAN, C. S., AND ELLERBROCK, V. J. *J. Opt. Soc. Amer.*, **37**, 635–41 (*Aug.*, 1947).—A theoretical investigation has been made of the "ground-glass-plate effect" and the "edge effect" [Abstr. 3051 (1942)]. Rectangular and disc-shaped objects have been considered. In computing the distribution of brightness across that part of the field of view occupied by the object, consideration has been given to the rays which would have been transmitted directly to the eye and rays which would have been scattered once between the object and the eye, but not to scattering of a higher order. Equations for computing the brightness in a given direction with respect to the object have been developed. A.

535.436 : 535.32 3157

Specular reflection from mercury vapor. HANSEN, J. M., AND WEBB, H. W. *Phys. Rev.*, **72**, 332–9 (*Aug.* 15, 1947).—The diffuse scattering of light by Hg vapour and specular reflection from a quartz/Hg vapour surface was investigated quantitatively. The vapour was contained in a quartz cell heated in an oven, and temps. given below are those of liquid Hg in contact with it. Both effects were observed over the range 100–300°C. Scattered radiation was max. at 50°C and $<0{\cdot}5\%$ at 300°C. Specular reflection was $<0{\cdot}5\%$ below 100°C, and was measurable at 125°C, where (wavelength) $\times \sqrt[3]{(\text{atoms/cm}^3)} \simeq 7$. From 150–300°C most of the incident energy of 2 537 Å radiation was dissipated in the vapour. The delay of emission was investigated; specular reflection showed no measurable delay; the emission/time curve of the scattered radiation was not affected by density above 75°C. The refractive index and absorption of dense Hg vapour were calculated from reflectivity data; their ratio was almost independent of vapour density. A.

535.515 : 537.228.3 : 541.182.6 = 4 3158

Concerning the alternating term in the electric birefringence of bentonite sols. RABINOVITCH, J. *J. Phys. Radium* (*Sér.* 8) **7**, 228–9 (*Aug.*, 1946) *In French.*—Previous work [*Phys. Rev.*, **55**, 508, 792 and 668 (1939); **56**, 615 (1939)] led to the consideration of the electric birefringence as the sum of a constant and an oscillatory term. Details of the experimental observation of the latter and the effect of ageing of the sols are given. The signs of the terms are discussed and a schematic explanation attempted, in which it is suggested that the case of the terms having opposite signs indicates the presence of at least two sorts of particles having different properties. H. G. J.

535.515 : 538.612 = 4 3159

Formulae representing the thermal variations of the magnetic birefringence of α-bromonaphthalene and of nitrobenzene. RABINOVITCH, J. *C.R. Acad. Sci., Paris*, **224**, 1420–1 (*May* 19, 1947) *In French.*—For α-bromonaphthalene the product of the Cotton–Mouton constant (C) and T is constant over a considerable range of temp. for a specific wavelength, and, consequently, the dispersion of C over the temp. range is invariable. With nitrobenzene, probably owing to molecular association, the relationship between C and T is less simple, and the dispersion ratio shows an increase with increase in temp. W. R. A.

535.551 3160

The photo-elastic properties of rubber. I. Theory of the optical properties of strained rubber. TRELOAR, L. R. G. *Trans. Faraday Soc.*, **43**, 277–84 (*May*, 1947).—From the consideration of vulcanized rubber as a network of randomly-kinked molecular chains, the optical constants corresponding to the most general type of homogeneous strain are derived. The rubber is shown to acquire the properties of an optically biaxial crystal, characterized by 3 principal refr. indices in the directions of the principal axes of strain. For directions of light propagation parallel to one of the principal axes the birefringence is shown to be a simple function of the principal extensions and $\propto$ the difference between the two corresponding principal stresses. If the rubber is swollen with a liquid having the same refr. index as itself, the birefringence, for a given state of strain, $\propto$ (swelling ratio)$^{-\frac{1}{3}}$, as do also the principal stresses. A.

535.551 : 548.5 3161

The photo-elastic properties of rubber. II. Double refraction and crystallisation in stretched vulcanised rubber. TRELOAR, L. R. G. *Trans. Faraday Soc.*, **43**, 284–93 (*May*, 1947).—From an investigation of the variation of birefringence with elongation in vulcanized rubber from −50° to +100°C, it is possible to distinguish the effects of crystallization from the true strain-birefringence. The latter agrees closely with theoretical expectations, in its dependence on stress and on elongation. The data do not permit of a quantitative estimation of the relative amounts of crystalline material present under various conditions. Experiments with stretched swollen rubber further confirm the theory and yield further evidence on the effects of crystallization. A.

535.566.2 3162

General theory of the rotatory power of isotropic media. HOEK, H. *Physica, 's Grav.*, **8**, 209–25 (*Feb.*, 1941).—A general expression is derived for the natural rotation of the plane of polarization by a homogeneous isotropic mixture of arbitrary molecules. If n is the refractive index of a solution, the non-specific influence of the solvent on the contribution made to the rotatory power by one active solute molecule is measured by the factor $(n^2 + 2)/3$. C. B. A.

535.642 3163

Distribution coefficients for the calculation of colours on the C.I.E. trichromatic system for total radiators at 1 500–250–3 500°K, and 2 360°K ($C_2 = 14\,350$). HARDING, H. G. W., AND SISSON, R. B. *Proc. Phys. Soc., Lond.*, **59**, 814–27 (*Sept.*, 1947).

535.642 = 5 3164

Dominant wave-length and saturation in colour specification. RAVAZZI, M. *Nuovo Cim.*, **2**, 35–9 (*April*, 1944) *In Italian.*—Describes the hue and saturation system of colour specification and its relation to the trichromatic system. J. W. T. W.

535.65 = 5 3165

Exact specification of a colour and determination of transmission factor for light. RAVAZZI, M. *Nuovo Cim.*, **1**, 363–71 (*Aug.*, 1943) *In Italian.*—After describing the trichromatic system of colour specification, the author shows how a transmission factor can be calculated either by the weighted ordinate method or by the use of selected ordinates. Two worked examples are given. J. W. T. W.

535.81 3166

Changes caused in the refractivity and density of glass by annealing. TOOL, A. Q., TILTON, L. W., AND SAUNDERS, J. B. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 519–26 (*May*, 1947).

535.82 : 535.42 3167

Phase contrast, a new method for the microscopic observation of transparent objects. I–II. ZERNIKE, F. *Physica, 's Grav.*, **9**, 686–98 (*July*); 974–86 (*Dec.*, 1942).—Abbe's theory is used to calculate the image of a phase-grating, and the resulting formulae are employed to discuss the schlieren method, oblique and central dark-ground illumination, and out-of-focus observation using a narrow cone of light. In contrast to these methods, the new phase-contrast method, in which the phase of the central diffraction image is changed, gives a close image of the true "form" of the object. In Part II an arbitrary object is considered by a different method. The use of strip and annular phase-plates is discussed. The use of an absorbing phase strip or annulus gives an increase in sensitivity. Methods are given by means of which the effects of diffraction by the phase-plate can be reduced. The preparation and adjustment of phase-plates are described. H. H. HOP.

535.822 3168

The most favorable absorption of the phase plate in phase contrast microscopy. BRICE, A. T., AND KECK,

H. *J. Opt. Soc. Amer.*, **37**, 647–51 (*Aug.*, 1947).—epting the conclusion of Zernike that phase structures in object may be converted into apparent amplitude ictures in its image by alteration of phase of portions the light at the Fraunhofer diffraction spectrum, a ple relationship between intrinsic object contrast and imum absorption of the phase plate is developed. this purpose, the definition of contrast as the ratio he brightness difference between adjacent small areas the image to the greater brightness of the two is ployed, and considered more suitable than the simple io of the brightest area to the darkest. The departure biologic structures from the periodicity and grating con- its characteristic of perfect object gratings is handled means of a parameter defined as the ratio of the energy nsmission by the null order of the diffraction spectrum the total energy transmission by all orders admitted the limited apertures of the microscope. Calculations ed on the formula developed are given in the form of les and graphs. A.

5.824.3 : 535.39 3169

Improvements in microscope illumination. BENFORD, R. *J. Opt. Soc. Amer.*, **37**, 642–7 (*Aug.*, 1947).—A mber of recent improvements are discussed. Several plications of complex-shaped optical elements of nsparent plastic are shown. A small fluorescent lamp signed for lower power microscopy is described. Two plications of movable condenser lens systems are given which the illuminated field and aperture are concur- ntly varied by the lens motion. Some applications of gh- and low-index interference films and of evaporated tallic films are described. The use of the new Zr ide source in microscopy is discussed. A.

5.87 : 535.393 *see Abstr.* 3153

5.89 : 535.33 : 771.448.1 3170

The nature of the light emitter in photo-flash lamps. ROCKMAN, F. G. *J. Opt. Soc. Amer.*, **37**, 652–9 (*Aug.*, 47).—On the basis of experimental evidence, it is ncluded that the light emitter in wire-filled photo-flash mps is an incandescent vapour. In the course of this udy the relative spectral energy distribution curves of vo common types of photo-flash lamps were obtained. A.

HEAT 536

36.21 : 536.48 3171

The heat conductivity of solid methane. GERRITSEN, . N., AND VAN DER STAR, P. *Physica*, *'s Grav.*, **9**, 03–12 (*May*, 1942).—The apparatus, which is a modified orm of that used by de Haas and Biermasz [Abstr. 53 (1935)] for the measurement of the thermal con- uctivity of solid CH_4 in the liquid H region, is described. The results obtained are exhibited graphically. The onductivity/temp. curve is similar to the specific eat/temp. curve, and has a discontinuity at the transition oint, 20·4°K. S. W.

36.21 : 621.365.5 : 538.54 = 4 *see Abstr.* 3261

36.212 : 537.312.62 3172

The thermal conductivity of lead in the superconducting nd normal states. DE HAAS, W. J., AND RADEMAKERS, . *Commun. K. Onnes Lab. Leiden* (*No.* 261c). *Physica*, r *Grav.*, **7**, 992–1002 (*Dec.*, 1940).—Measurements were nade from 2°K to 20°K by an improved technique. Below the transition point (7·2°K) the thermal resistance n a transverse magnetic field strong enough to destroy uperconductivity was higher than that in the super- onducting state, the normal curve departing sharply rom the superconducting one. For magnetic fields between $\frac{1}{2}H_c$ and H_c (critical field) the thermal resistance varied linearly with field. D. S.

536.23 3173

Thermal conductivity of gases at high pressures. COMINGS, E. W., AND NATHAN, M. F. *Industr. Engng Chem.*, **39**, 964–70 (*Aug.*, 1947).—A method is described for predicting the thermal conductivity of a gas at high pressures from its value at atmos. pressure, and the critical temp. and pressure, based on Enskog's equation of state and viscosity/density and thermal conductivity/density relations. The values of the constants are calculated from published data for N_2, CH_4, C_2H_4 and C_3H_8, and the resulting thermal conductivity values given in the form of graphs. The effect of pressure on the Prandtl number ratio is also shown by graphs.

536.23 : 545.7 *see Abstr.* 3346

536.244 : 533.6.013.22 3174

Heat transfer at low temperatures between tube walls and gases in turbulent flow. HALL, T. A., AND TSAO, P. H. *Proc. Roy. Soc. A*, **191**, 6–21 (*Sept.* 26, 1947).—A counter-flow apparatus is described. O_2, N_2 and CO_2 were used, covering a temp. range of ·45 to −167°C, pressures up to 11 atm. and Reynolds' numbers from 3 000 to 60 000. A general equation was obtained, independent of the gas and applicable over the whole range of the experiments: the coefficient was 5% < that obtained at normal and high temps. The effect of heat transfer on the friction factor was small. A.

536.25 3175

Heat dissipation of parallel plates by free convection. ELENBAAS, W. *Physica*, *'s Grav.*, **9**, 1–28 (*Jan.*, 1942).—The free convection loss from two vertical heated Al plates is measured for different separations, correction being made for radiation loss. Starting with the hydrodynamical equations this loss is expressed as an exponential function of the Nusselt, Grashof and Prandtl numbers. Correction for edge effects, to make the plates ∞ in the horizontal direction, gives good agreement between theory and experiment. At separations >1·0–1·5 cm the heat loss is independent of the separation and $\propto$ (height)$^{-\frac{1}{4}}$. The results are applied to the cooling of a heated member by means of fins perpendicular to its axis. E. H. D.

536.25 3176

The dissipation of heat by free convection of spheres and horizontal cylinders. ELENBAAS, W. *Physica*, *'s Grav.*, **9**, 285–96 (*March*, 1942).—Convection heat loss from a hot sphere is deduced from a theory due to Langmuir and previous work by the author [Abstr. 3175 (1947)]. Experimental results are obtained for the convection loss from polished Al spheres and cylinders and from a Pt wire. When allowance is made for the temp. variation of density, conductivity, and viscosity there is good agreement with the theory. Spheres have the higher heat loss for the same diameter and temp. excess. E. H. D.

536.25 3177

The dissipation of heat by free convection. Horizontal and vertical cylinders; spheres. ELENBAAS, W. *Physica*, *'s Grav.*, **9**, 665–72 (*July*, 1942).—The methods of Abstr. 3176 (1947) are extended to the convection loss from vertical cylinders and the previous results are expressed in a different form. No reliable data are available for comparison with the theoretical result. E. H. D.

536.25 3178

The dissipation of heat by free convection. The inner surface of vertical tubes of different shapes of cross-section. ELENBAAS, W. *Physica*, *'s Grav.*, **9**, 865–74

(*Sept.*, 1942).—Earlier results [Abstr. 3176 (1947)] are applied to the loss in a circular tube when height ≫ diameter. Extension to other shapes of cross-section involves a formula due to Boussinesq. Comparison with experiment shows fairly good agreement, and it is shown that while a triangular section is theoretically the best, it is not superior in practice to a square section. The latter gives a higher dissipation than parallel plates at the optimum value of the sectional area. E. H. D.

536.42 : 536.71 3179

On the thermodynamical proof of Maxwell's rule for the evaluation of the pressure of a saturated vapour. DEKKER, J. W. *Physica, 's Grav.*, **8**, 59–64 (*Jan.*, 1941).—The hypothetical part of the continuous theoretical isotherm relating to the liquid-vapour-gas states being regarded as an interpolation between parts of the isotherm which can be realized experimentally, it is shown that Maxwell's rule for the pressure of the saturated vapour can be deduced without assuming that the substance might pass somehow from the liquid to the vapour state along the hypothetical part. J. S. G. T.

536.421.5 + 536.422.5 3180

The nucleation of ice formation by silver iodide. VONNEGUT, B. *J. Appl. Phys.*, **18**, 593–5 (*July*, 1947).—AgI particles can serve as nuclei for the formation of ice crystals in super-cooled water and in water vapour super-saturated with respect to ice, the close resemblance in crystal structure between ice and AgI being believed to be an important factor in the nucleation. The max. temp. at which nuclei are formed is ~ −4°c for particles of 1 μ dia. and −8°c for particles 100 Å dia. An AgI smoke generator has been constructed which consumes 1 mg/sec AgI and produces 10^{13} effective nuclei/sec. A.

536.422.5 + 536.421.5 *see Abstr.* 3180

536.423.1 : 541.123.2 *see Abstr.* 3328–30

536.423.1 : 541.123.2/.3 *see Abstr.* 3331

536.423.15 = 4 3181

Empirical relation connecting the density of a liquid with that of its saturated vapour. MEZGER, E. *C.R. Acad. Sci., Paris*, **225**, 108–9 (*July* 16, 1947) *In French.*—The relation $d_{liq.}^{2/3} + d_{vap.}^{2/3} = 2d_{crit.}^{2/3}$ holds within ~ 6% for many liquids, including water and benzene. It is more accurate than the law of rectilinear diameters. A. J. C. W.

536.46 : 533.15 : 539.155.2 = 3 3182

On the isotope separation in ascending H_2–D_2 flames. CLUSIUS, K., AND FABER, G. *Z. Naturforsch.*, **2a**, 97–9 (*Feb.*, 1947) *In German.*—Repetition of an earlier experiment [Abstr. 459 (1942)] by an improved method, which confirms the earlier results. On increasing the concentration of a mixture of equal parts of H_2 and D_2 in oxygen the limiting value $2{\cdot}2_2$ for the ratio of the concentration ratios of D_2 to H_2 after and before the combustion is obtained. This agrees well with the value $2{\cdot}1_6$ calculated on the assumption that the process is governed by the diffusion velocities of the two isotopes. H. L.

536.48 3183

Isotherms of helium at liquid helium temperatures. KEESOM, W. H., AND WALSTRA, W. K. *Commun. K. Onnes Lab. Leiden* (*No.* 260c). *Physica, 's Grav.*, **7**, 985–91 (*Dec.*, 1940).—Results are given in tabular and in graphical form, and a table of the virial coefficients is given. The second virial coefficient is compared with the results of other workers. The third is distinctly negative at and below the boiling point of He. G. L. W.

536.48 : 532.13 *see Abstr.* 3076

536.48 : 536.21 *see Abstr.* 3171

536.48 : 536.53 3184

Determination of thermodynamic temperatures between 1·5 and 0·25°K. VAN DIJK, H. *Commun. K. Onnes Lab. Leiden* (*No.* 270a). *Physica, 's Grav.*, **12**, 371–95 (*Sept.*, 1946).—Measurements of thermodynamic temps. of $Gd_2(SO_4)_38H_2O$ were made by the caloric method of Keesom [Abstr. 1284 (1937)]. This method enables one to obtain the thermodynamic temps. of paramagnetic substances by means of a combination of measurements of specific heats and of demagnetizations, without any assumption as to the dependence of their susceptibility on temperature and magnetic field strength. The susceptibility, specific heat and entropy were then calculated, and the experimental relation between χ and T was compared with theory. The data are in better agreement with Onsager's and van Vleck's theories than with Lorentz. At the lowest temperatures, nevertheless, considerable deviations occur. A.

536.48 : 536.63 *see Abstr.* 3191–2

536.48 : 536.63 = 3 *see Abstr.* 3193

536.48 : 537.56 : 537.531 *see Abstr.* 3218

536.48 : 538.222 *see Abstr.* 3254

536.48 : 538.24 : 536.7 3185

On the importance of caloric measurements for the knowledge of the functions S, σ and U of paramagnetic salts at low temperatures. VAN DIJK, H. *Commun. K. Onnes Lab. Leiden* (*Suppl. No.* 90b). *Physica, 's Grav.*, **8**, 67–80 (*Jan.*, 1941).—Expressions for entropy, magnetization and internal energy are deduced in terms of 3 measurable thermal quantities (specific heat at const. field and at const. magnetization, and heat of isothermal magnetization per unit field) by means of the second law of thermodynamics. Some special cases are discussed where the expressions involve only one or two of these quantities. D. S.

536.5 3186

The melting point of mercury and the triple point of carbon dioxide as auxiliary fixed points for the temperature scale. MICHELS, A., BLAISSE, B., AND KOENS, G. *Physica, 's Grav.*, **9**, 356–62 (*March*, 1942).—A Pt thermometer and the apparatus for calibrating the thermometer at these auxiliary fixed points are described with diagrams. The reproducibilities of the points were 0·0005 and 0·0002 deg. respectively. S. W.

536.5 : 537.527 *see Abstr.* 3211

536.5.081.4 : 535.234 = 5 3187

Temperature scale and properties of tungsten. GARELLI, C. M. *Nuovo Cim.*, **1**, 101–19 (*April*, 1943) *In Italian.*—Describes the various methods of expressing the radiation from an incandescent body, viz. true temp., brightness temp. and colour temp., and the relation between them and the emissivity of the body. A résumé of the relevant properties of W are then given, and a suggestion made for a temp. scale based on the brightness of a polished surface of pure W. J. W. T. W.

536.516.2.072.2 : 621.317.78 3188

A new differential thermometer for use in r.f. power measurement. DYSON, J. *J. Sci. Instrum.*, **24**, 208–10 (*Aug.*, 1947).—An instrument for the measurement of small temp. differences such as are encountered in the calorimetric measurement of r.f. power is described. It consists of two adjacent flow chambers, with windows for the passage of light, each chamber containing a "High heat 49" bimetal strip, 0·008 in thick, immersed in the water stream. A small mirror is fixed to the free end of each strip, and the temp. difference between the

er streams is determined from the deviation of a m of light reflected from the two mirrors in succession. ails of the optical system, of the construction of the v chambers, and of the performance of the instrunt, are given. Full scale deflection corresponds to 2·5°c, the instrument being linear within experimental or. S. W.

.53 : 536.48 *see Abstr.* 3184

.53 : 621.318.4.045.5 3189

Accuracy of temperature measurements on coil surfaces. SDE, H. M., AND CAIN, B. M. *Trans. Amer. Inst. ct. Engrs (Prepr.* 47—94) 6 *pp.*—[Abstr. 2781 B (1947)].

.531 3190

A simple carbon-resistance thermometer for low peratures. FAIRBANK, H. A., AND LANE, C. T. *Rev. Instrum.*, **18**, 525–6 (*July*, 1947).—The resistance rmometer consists of a phenolic base in the form of a all card, coated with amorphous carbon. The card n be cut into any desired shape. Contact can be made the carbon by means of colloidal silver, and wire leads n be conveniently soldered to it by means of Wood's tal. A wide range of resistance is available. At uid He temperatures, the resistance of these elements shown to $\propto 1/T$. H. K. H.

6.55 : 535.338.4 *see Abstr.* 3120–3

6.55 : 537.523.5 *see Abstr.* 3209

6.63 : 536.48 3191

Measurements of specific heats of iron ammonium alum high magnetic fields and at liquid helium temperatures. N DIJK, H., AND KEESOM, W. H. *Commun. K. Onnes b. Leiden* (*No.* 260*b*). *Physica*, *'s Grav.*, **7**, 970–84 ec., 1940).—Measurements were made in zero field om 0·15° to 4·2°K and in fields up to 17 680 gauss om 1° to 4·2°K. All the curves of c against T showed anomalous max. at 3·6°K which could not be exained; the results at lower temps are in fair agreement th a Brillouin function assuming 6 equally spaced ergy levels in the ground state. D. S.

6.63 : 536.48 3192

The specific heat of liquid helium from 1·5°K down to 4°K. KEESOM, W. H., AND WESTMIJZE, W. K. *Physica*, *Grav.*, **8**, 1044 (*Nov.*, 1941).—The specific heat is ughly represented by $c = 0{\cdot}023\,T^6$ cal/g deg. from 5°K to 0·6°K. Below 0·6°K it is probable that the wer of T decreases. G. L. W.

6.63 : 536.48 = 3 3193

Results of low temperature research. III. The electron at of Pd. CLUSIUS, K., AND SCHACHINGER, L. *Z. aturforsch.*, **2a**, 90–7 (*Feb.*, 1947) *In German.*—etermination of the specific heat C_p of Pd between 12° d 270°K. C_v is calculated from C_p and from known ermodynamic data by assuming an electron heat $= 2{\cdot}22\,\chi T$, where χ is the temp.-dependent para-agnetic atom-susceptibility; the lattice heat $C_g = - C_e$ can be represented by a single Debye function, th Θ between 275° and 295°K. Using data given in erature, these calculations are extended to 1 000°K. ey show that the relation remains valid up to this mp. From this follows that no noticeable effect due to harmonic lattice vibrations is present. H. L.

6.631 : 548.0 = 4 3194

The anomaly in the heat capacity presented by crystals basic beryllium acetate in the neighbourhood of 40°c. FFRAY, J. *C.R. Acad. Sci., Paris*, **225**, 106–7 (*July* 16, 47) *In French.*—Cf. Abstr. 2933 (1943). The heat pacity increases from 132 cal/mole/°c at 25°c to a oint maximum >150 at 40·5°, falling steeply to 125 ~ 42°. A. J. C. W.

THERMODYNAMICS 536.7

536.7 : 538.24 : 536.48 *see Abstr.* 3185

536.71 : 536.42 *see Abstr.* 3179

536.71 : 541.123 = 4 3195

Stable stationary transformations and azeotropic transformations. PRIGOGINE, I., AND DEFAY, R. *Bull. Acad. Belge. Cl. Sci.* (*Sér.* 5) **32**, 694–703 (*Dec.*, 1946) *In French.*—In previous publications it has been shown that certain stationary transformations entail a minimum production of entropy. The present paper dealing with the distillation of a binary mixture gives a new confirmation of this fact. The minimum production of entropy is closely connected with the stability of the transformation. The stability of transformations at const. temp. and pressure being considered, the results enable the problem of the stability of azeotropic transformations to be discussed. F. E. H.

536.71 : 541.123 = 4 3196

The stability of azeotropic transformations. PRIGOGINE, I., AND DEFAY, R. *Bull. Acad. Belge. Cl. Sci.* (*Sér.* 5) **33**, 48–53 (*Jan.–Feb.*, 1947) *In French.*—A study of the transformations between the liquid and vapour phases of a binary mixture. In the case of azeotropic vaporization the transformation is shown to be stable when the equilibrium curves have a maximum pressure, at a given temperature (positive azeotropy) and unstable when the equilibrium curves show a minimum pressure (negative azeotropy). The converse is valid for azeotropic condensation. These results are obtained directly by considering the irreversible phenomena occurring in the change of phase, and not as in the classical theory of distillation by assuming the equilibrium of the liquid and vapour phases. F. E. H.

ELECTRICITY 537

537.122 : 530.145 *see Abstr.* 3062

537.122 : 530.145 = 4 *see Abstr.* 3063

537.133 : 778.3 : 539.164.1 *see Abstr.* 3300

537.226.3 : 537.226.8 : 621.315.611 : 621.317.37 3197

The relation between the power factor and the temperature coefficient of the dielectric constant of solid dielectrics. GEVERS, M.

I. Summary of theories. *Philips Res. Rep.*, **1**, 197–223 (*April*, 1946).—A short review of existing theories is given (44 refs.) and it is shown that none is able to explain the nearly const. ratio of power factor to temp. coeff. of permittivity (~16·6) for most solid dielectrics.

II. Summary of published measurements. *Ibid.*, 279–97 (*Aug.*, 1946).—The data of earlier investigations on dielectric losses and temp. coeff. is reviewed and tabulated (49 refs.). Inconsistencies make this data inadequate for the investigation of the above relationship.

III. A new theory on the dielectric losses, the temperature coefficient of the dielectric constant of amorphous solid dielectrics, and the relation between these quantities. *Ibid.*, 298–313 (*Aug.*, 1946).—A broad, nearly constant, distribution function is allotted to the activation energies of the particles giving rise to dielectric losses (which usually contain long molecule chains, irregularly distributed) in respect of neighbouring field forces. The time needed for acquiring the activation energy under the action of an electric field is treated by analogy with diffusion theory, and the contribution of particles of different relaxation times analysed. A similarity principle between the power factor/temp. function at const. frequency and the power factor/frequency function at const. temp. is discovered. The form of the activation

energy distribution curve is determined by the power factor/temp. function, and the above-mentioned relation with the temp. coeff. of permittivity emerges from the theory. Some remarks are made about the properties of mixtures of dielectrics.

IV. Apparatus. *Ibid.*, 361–79 (*Nov.*, 1946).—The power factor is measured by means of the well-known reactance variation method, using a thermionic voltmeter as detector of resonance. In the measurement of temp. coefficient of capacitance, the test capacitor and a standard capacitor are connected in parallel with the tuning circuit of an oscillator. The oscillator is maintained at a const. frequency throughout the temp. run, and the change of capacitance with temp. is then equal to the amount by which the standard capacitor has to be varied to keep the frequency const. The measurements were made over a temp. range of −180° to +180°C and a frequency range of 80 kc/s to 40 Mc/s. E. R.

V. Results of the measurements of the power factor and the temperature coefficient of the dielectric constant of dielectrics. *Ibid.*, 447–63 (*Dec.*, 1946).—Both quantities were measured with the equipment of Part IV for a number of solid materials (e.g. quartz, marble, glass, ebonite, wood) and results for 16 of them are tabulated. These are discussed in detail, and anomalous cases considered, also the effect of the admixture of foreign substances. All the experimental results are in accordance with the theory of Part III.

537.226.8 : 621.315.611 : 621.317.37 : 537.226.3 *see Abstr.* 3197

537.228.3 : 541.182.6 : 535.515 = 4 *see Abstr.* 3158

537.228.5 : 535.338.334 : 537.523.4 *see Abstr.* 3207

ELECTRIC CURRENTS 537.3

537.311.1 : 539.1 *see Abstr.* 3267

537.311.1 : 548.0 : 539.1 *see Abstr.* 3268

537.311.33 = 3 3198

An interpretation of forming phenomena in selenium barrier-layer rectifiers. Rose, F., and Schmidt, H. *Z. Naturforsch.*, **2a**, 226–33 (*April*, 1947) *In German.*—Capacitance measurements on Se rectifiers have shown that the mobility of the impurity centres under the influence of the applied electric field cannot be neglected during calculations. Forming phenomena can be interpreted as a consequence of a redistribution of impurity centres in the barrier layer, whereby some of the centres are probably able to enter the counter-electrode. During the forming process the concentration of impurity centres in the immediate neighbourhood of the counter-electrode increases, whereas that at greater distances decreases. This results in a higher barrier resistance. Current creep phenomena during intermittent operation of the rectifier disc are also discussed. H. K. H.

537.311.33 : 621.315.59 3199

Electronic conductivity of non-metallic materials. Verwey, E. J. W. *Philips Tech. Rev.*, **9** (*No.* 2) 46–53 (1947).—A general introduction to the band theory of insulators and semi-conductors, with special reference to the connection between conductivity, photo-conductivity, light-absorption and the stoichiometric composition of the materials concerned. The various effects are illustrated on KCl. Great care must be taken in the practical employment of materials which are liable to change their stoichiometric composition during use. H. K. H.

537.311.33 : 621.315.59 3200

The physics of electronic semi-conductors. Pearson, G. L. *Trans. Amer. Inst. Elect. Engrs* (*Prepr.* 47—34) 13 *pp.*—A general and brief introduction to the band theory of solids, with special reference to the mechanism of impurity semi-conduction. Some typical properties of intrinsic and impurity semi-conductors, like Hall effect, thermo-electric effect and contact rectification are discussed. A brief account is also given of the properties of thermistors, i.e. sintered mixtures of NiO, Mn_2O_3 and Co_2O_3 in varying proportions. H. K. H.

537.311.35 = 5 3201

The electric conductivity of sodium-ammonia solutions at low temperatures. Giulotto, L., and Gigli, A. *Ric. Sci. Ricostruz.*, **17**, 62–5 (*Jan.*, 1947) *In Italian.*—Slow cooling of Na–NH_3 solutions causes an increase of resistance near the freezing point followed by a rapid decrease to a value which is well below the resistance in the liquid state but is still measurable. Experiments carried out to confirm the existence of persistent currents induced in *rapidly* cooled Na–NH_3 films [Abstr. 1894 3156 (1946), 878 (1947)] gave a negative result. H. L.

537.311.4 : 541.183.56.08 *see Abstr.* 3343

537.312.62 = 3 3202

Superconductivity and Hertzian oscillations. von Laue M. *Z. Phys.*, **124** (*Nos.* 1–2) 135–43 (1947) *In German.*—Discussion of some early measurements of the h.f resistance of Ta [Abstr. 3876 (1932), 346 (1933)] on the basis of the electrodynamics of superconductors of F. and H. London shows that these experiments can be understood if one assumes a gradual increase of the number of superconducting electrons and a gradual decrease of the ohmic conductivity when the temp. is lowered below the transition point. [See also Abstr. 137 (1941)]. H. L.

537.312.62 = 3 3203

On the theory of superconductivity. Heisenberg, W. *Z. Naturforsch.*, **2a**, 185–201 (*April*, 1947) *In German.*—The Coulomb interaction in a Fermi gas is of importance for electrons which have max. energy. A model of spatial order produced by the long range of the Coulomb interaction is given and the relation to the electric and thermodynamic behaviour of superconductors discussed. If these considerations, which the author considers as a programme rather than a theory, are correct, superconductivity should be a phenomenon common to all genuine electronic conductors (except ferromagnetic substances). However, the transition points may differ by several orders of magnitude; the highest transition points would be found with conductors of the narrowest energy bands, i.e. with those of lowest normal conductivity. H. L.

537.312.62 : 536.212 *see Abstr.* 3172

537.324 : 535.23.08 *see Absir.* 3102

537.363 : 535.31 = 4 *see Abstr.* 3107

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.523.3 3204

Negative corona in freon-air mixtures. Weissler, G. L., and Mohr, E. I. *Phys. Rev.*, **72**, 289–94 (*Aug.* 15, 1947).—The mixtures used ranged from 10^{-4} to 100% of freon-12 in dry air. The onset potentials of the intermittent corona region were constant in all mixtures, ~ 6 to 7 kV with $X/p \simeq 100$; only in pure freon it changed to 12·6 kV with $X/p \simeq 200$. Concentrations of freon up to 1% revealed corona characteristics very similar to those of air. From 1 to 20% mixtures showed rapidly decaying Trichel pulses. Upon analysis this seems due to the formation of Cl^- and F^-, which are shown to be still stable at values of $X/p \geq 200$. As a consequence, negative space charges

, be stable in regions much closer to the corona point n in air and will, therefore, be more efficient in pressing the discharge, as is indicated by decaying se sizes. At still higher concentrations the more ole Cl^- and F^- formed heavier space charges, initing the formation of large electron avalanches to h an extent that only incipient Trichel bursts were duced. Thus the range of potential of the intertent corona region was extended to higher values, the corona current *v.* potential curves showed rapidly reasing slopes with increasing amounts of freon. A.

7.523.3 3205

Positive corona in freon-air mixtures. MOHR, E. I., WEISSLER, G. L. *Phys. Rev.*, **72**, 294–7 (*Aug.* 15, 7).—In this investigation of positive corona, streamer ses increased in frequency and strength to a maximum 1% of freon in air. The visual characteristic of the ona changed markedly, indicating also that the disge sustained itself largely by the streamer mechanism. e dissociation of freon by the discharge created stable $^-$ and F^- ions which neutralized the positive space rges and therefore stimulated streamers. As the freon ntent was increased, streamers degenerated until they uld not be distinguished from burst pulses. The onset tentials were shifted to higher values and the current *v.* tential curves showed decreasing slopes with increasing ounts of freon. A.

7.523.3 : 537.525.8 = 3 3206

The breakdown voltages, between hot electrodes, of rare s/nitrogen mixtures. VAN LIEMPT, J. A. M., AND VAN K, W. D. *Physica*, *'s Grav.*, **11**, 167–78 (*March*, 44) *In German.*—The phenomena associated with the pearance of electrical breakdown in gas-filled discharge es filled with rare gas/N_2 mixtures (total pressures -76 cm Hg, N_2 conc. 0–100%) are studied. Measureents of breakdown voltage as a function of gas pressure, content and electrode temp. and spacing were made.

J. D. C.

7.523.4 : 535.338.334 : 537.228.5 3207

Ion concentrations in spark channels in hydrogen. AGGS, J. D., AND HOPWOOD, W. *Proc. Phys. Soc.*, *nd.*, **59**, 755–71 (*Sept.*, 1947).—Ion concentrations in drogen spark channels may, it is shown, be found by serving the Stark broadening of the Balmer lines. e line breadths are measured by photography or by otting with a photo-electric electron multiplier, amplier and c.r.o. With the latter method the light emison/time relation can be studied and representative cillograms are shown. Full account must be taken of e fine structure of the lines in assessing their true eadths, and Holtsmark's theoretical analysis of the ark effect for inhomogeneous fields is used for that rpose. A.

7.523.4 : 537.568 *see Abstr.* 3232

7.523.5 = 3 3208

On the influence of ambipolar diffusion in an arc discharge. WEIZEL, W., AND SCHMITZ, G. *Z. Phys.*, **124** *fos.* 1–2) 68–76 (1947) *In German.*—The effect of ermal conduction losses on the radial variations of mp. in a Hg arc are studied and found to be only of a cond order. J. D. C.

7.523.5 : 536.55 3209

A new method of determining the temperature of a high-essure discharge. ELENBAAS, W. *Physica*, *'s Grav.*, **9**, 1–64 (*Jan.*, 1942).—The excitation temp. of arcs (e.g. Hg apour, 1 atmos.) may be found by determining the ratio axial and off-axis intensities for various spectral lines known initial level energies. A plot of these ratios against the respective energies of the initial levels enables the axial and off-axis temps. to be found, in the absence of self-absorption. It is unnecessary to know the transition probability for the states involved in the measurements. The method was applied in some preliminary experiments with an Hg/Cd vapour arc.

J. D. C.

537.523.5 : 537.56 = 393 3210

The applicability of Saha's formula to the electric arc. KRUITHOF, A. M., AND SMIT, J. A. *Physica*, *'s Grav.*, **11**, 129–43 (*March*, 1944) *In Dutch.*—The extent of applicability of Saha's equation (giving the degree of ionization of a gas in thermal equilibrium) to arc discharges is discussed. The required data, i.e. (*a*) electron, (*b*) ion and (*c*) atom concentrations, and (*d*) discharge temp. were obtained respectively by measurements of current, field strength, electron mobility and "arc diameter" (*a*), by standard spectroscopic methods (*b* and *c*), and by observations of intensity ratios in the CN bands (*d*). Tests were made with d.c. and a.c. arcs in air at 1 atmos. containing Sr and Ba vapour. The conclusion was that Saha's equation is applicable to this case, with an error of about ±20% in the value of the amount of ionization.

J. D. C.

537.525.8 : 537.523.3 = 3 *see Abstr.* 3206

537.527 : 536.5 3211

On the excitation temperature, the gas temperature, and the electron temperature in the high-pressure mercury discharge. ELENBAAS, W. *Philips Res. Rep.*, **2**, 20–41 (*April*, 1947).—Measurements of these temps. (respectively T_{ex}, T_g and T_e) were made in a Hg vapour arc at 1 atmos. press. It was found that $T_{ex} \simeq T_e$, with $T_{ex} > T_g$. $(T_{ex} - T_g)$ is probably $\not> 200°K$ at the discharge axis where $T_{ex} = 5\,350°K$. The methods used for determining T_{ex} and T_g are described in detail. J. D. C.

537.528 3212

On the electrical breakdown in liquefied gases. KRONIG, R., AND VAN DE VOOREN, A. I. *Physica*, *'s Grav.*, **9**, 139–44 (*Jan.*, 1942).—Some sphere/plane breakdown measurements in pure liquefied A, N and O were made with a Wimshurst machine. The results are in general agreement with the theory, which is briefly discussed.

J. D. C.

537.531 : 535.072 : 535.338.334 3213

On the resolving power of the ordinary X-ray spectrograph and the natural width of X-ray spectral lines. COSTER, D., AND DE LANG, H. *Physica*, *'s Grav.*, **13**, 379–84 (*Aug.*, 1947).—It has been shown [Abstr. 4075 (1939)] that the resolving power of the photographic X-ray spectrograph, using a calcite crystal, depends on its dimensions. A large spectrograph has been made and line-widths of Ag, $K\alpha_1$ and $K\alpha_2$ determined with it are noticeably smaller than those formerly obtained with a double X-ray spectrometer [Abstr. 4143 (1933)]. A.

537.531 : 535.33 3214

A solid-state interpretation of the structure near the limit of the continuous X-ray spectrum. DUMOND, J. W. M. *Phys. Rev.*, **72**, 276–83 (*Aug.* 15, 1947).—Irregularities in the continuous X-ray spectrum at low [Abstr. 1873 (1947)] and high voltages [Abstr. 2149 (1937)] are interpreted in terms of the permitted and excluded energy states for the electron in the crystal lattice in its final state after having radiated the X-ray photon. The paper explains (1) how negative slopes in the isochromats from a thick target are possible, (2) why the irregularities are much more pronounced for low than for high voltage isochromats, (3) how the observed isochromat curves may be corrected for the varying

retardation of the cathode-ray electrons at varying depths beneath the surface of the target to obtain information regarding the transition probabilities and energy levels for the excluded and permitted empty energy bands for electrons in the target crystal lattice. A.

537.531 : 535.34 : 545.824 : 531.717 = 4 3215

Contribution to the study of the measurement of the absorption of X-rays by matter. DEVAUX, J. *Ann. Radioélectricité*, **2**, 109–32 (*April*, 1947) *In French.*—The specimen whose absorption is to be measured is placed near the focus of a curved-quartz monochromator, the incident beam passing through an ionization chamber of variable sensitivity, and the transmitted beam entering an ionization chamber of constant sensitivity. The variation in sensitivity is achieved by a shield with a tapering slot moved by a micrometer screw over the collecting electrode, thus changing its effective area. The construction of both chambers is described in detail. The ionization currents are in opposite senses; their sum is applied to an electrometer or electrometer valve, and the position of the micrometer is adjusted to give zero total current. The method is thus independent of fluctuations in the X-ray beam. The absorption is obtained by a substitution method, a series of standard absorbers based on 49·0 for the mass absorption coefficient of Al for Cu $K\alpha$ radiation (Compton and Allison, *X-rays in theory and experiment*, London, 1935, pp. 799 *et seq.*) being employed. The micrometer readings are used to interpolate between successive members of the series. The voltage applied to the X-ray tube was < that required to excite radiation of wavelength $\lambda/2$. The following values were obtained for mass absorption coefficients:

	H	C	N	O
Cu $K\alpha$	0·69	4·28	7·10	11·25
Mo $K\alpha$	0·53	0·56	0·89	1·22

(error $\sim 0{\cdot}4\%$). The agreement with the values given by Compton and Allison is good; those given by Bragg (*The crystalline state*, London, 1933, pp. 325–7) are 10–20% higher. The atomic absorption coefficients were found to be additive within the experimental error for a range of organic liquids, but there was a discrepancy of 1% for water. Applications to chemical analysis, impurity detection, segregation in alloys, thickness measurement and photometry are described. A. J. C. W.

537.531 : 535.343 = 4 3216

X-ray absorption spectra of some divalent nickel salts and their aqueous solutions. CAUCHOIS, Y. *C.R. Acad. Sci., Paris*, **224**, 1556–8 (*June* 2, 1947) *In French.*—The solutions (concentrations varying from normal to saturated) were contained in cells 0·005–0·1 cm deep closed by thin mica sheets. Salts and solutions showed an absorption discontinuity at $\sim 1{\cdot}483$ kX, a max. absorption at $\sim 1{\cdot}482$, and three bands in the neighbourhood of 1·478, 1·466 and 1·450. The positions of the discontinuity, etc., vary ~ 1 kX according to the compound and concentration. A. J. C. W.

537.531 : 535.42 : 548.73 3217

A new formula for the breadth of Debye–Scherrer lines. BOUMAN, J., AND DE WOLFF, P. M. *Physica, 's Grav.*, **9**, 833–52 (*Sept.*, 1942).—If Z is the thickness of the crystal, measured $\perp$ to the reflecting planes, the integral breadth is $K\lambda/\cos\theta$, where $K = \bar{Z}/\bar{Z}^2$. For the ½-breadth, K is given approx. by $K^2 = 12\log_e 2\bar{Z}^2/\pi^2\bar{Z}^4$. The variation of K with indices of reflection is discussed for certain crystal shapes. A. J. C. W.

537.531 : 537.56 : 536.48 3218

X-ray ionization in liquefied gases. GERRITSEN, A. N., AND KOOLHAAS, J. *Commun. K. Onnes Lab. Leiden* (*No.* 266*b*). *Physica, 's Grav.*, **10**, 49–56 (*Jan.–Feb.* 1943).—Measurements were made on liquid N at its boiling point and on liquid He at various temps. The measured ionization-temp. curve shows remarkable behaviour near the λ-point of He, but farther away there was no essential difference in the behaviour of He I and He II. G. L. W.

537.533 : 539.153 = 3 *see Abstr.* 3288–9

537.533.1 : 621.385 3219

Space charge current theory and the mechanical impulse of the electrons. SELÉNYI, P. *Physica, 's Grav.*, **8** 885–902 (*Sept.*, 1941).—The effect of space charge and electron momentum on the electrostatic forces between the electrodes is investigated. In a space-charge-limited diode the momentum of the anode current balances the e.s. force. The off-cathode field in the case of a space-charge min. can be easily calculated using mechanical considerations giving the Langmuir formula. Experiments which directly indicate the effects of momentum are described. A. H. W. B.

537.533.7 : 621.385.83 3220

The electron mechanics of induction acceleration. RAJCHMAN, J. A., AND CHERRY, W. H. *J. Franklin Inst.* **243**, 261–86 (*April*); 345–64 (*May*, 1947).—[Abstr. 2812 E (1947)].

537.533.74 = 4 3221

The back-scattered component of the secondary emission in metals. PALLUEL, P. *C.R. Acad. Sci., Paris*, **224** 1492–3 (*May* 28, 1947) *In French.*—The inelastically reflected component of secondary emission was measured for 9 metals over the range 1–18 kV. A. H. W. B.

537.533.74 = 4 3222

The mechanism of back-scattering of electrons by metals. PALLUEL, P. *C.R. Acad. Sci., Paris*, **224**, 1551–3 (*June* 2, 1947) *In French.*

537.533.8 3223

Secondary electron emission from metals with a low work function. BRUINING, H. *Physica, 's Grav.*, **8** 1161–3 (*Dec.*, 1941).—Describes experiments made to investigate differences between the author's earlier results and those of Kollath. It is shown that if oxidized bulk metal surfaces of Al and Be are sputtered in A before δ is measured, the resulting value of δ is substantially the same as that obtained from a sublimed film of the metal, as used in the earlier work, and $\simeq 1$. Values of 5–6 characterize an oxidized surface layer. A. H. W. B.

537.534.72 : 621.385.833 = 4 3224

Optics of electrostatic lenses and the proton microscope. CHANSON, P. *Ann. Phys., Paris* (*Sér.* 12) **2**, 333–41 (*July–Aug.*, 1947) *In French.*—Describes in detail the electron-optical properties of symmetrical electrostatic lenses. The theoretical possibilities and practical realization of a proton microscope are discussed, and it is concluded that, by using accelerating potentials $> 300\,000$ V and suitable object supports, useful magnifications $> 600\,000$ should be obtainable. H. J. H. S.

537.534.74 : 539.152.1 *see Abstr.* 3279

537.534.74 : 539.152.1 = 3 3225

Theory of scattering of fast charged particles. I. Single scattering in a screened Coulomb field. MOLIÈRE, G. *Z. Naturforsch.*, **2a**, 133–45 (*March*, 1947) *In German.*—An analytic solution of the problem of elastic scattering is developed and applied to the case of the Thomas–Fermi field. The solution retains its validity over the inter-

ate region where neither classical methods nor 's approximation can be used. It holds for scatter- angles $\leqslant 90°$ and for k.e. of incident particle $Z^{4/3}$. 100 eV (Z = atomic no. of scattering atom, charge of scattered particle). A. P. F.

534.9 3226

ng deposits on surfaces bombarded by canal rays. LONKAR, V. T. *Indian J. Phys.*, **21**, 17–28 (*Feb.*,).—The phenomenon (observed when hydrocarbon tances are present in the discharge tube) has been ied as a function of the nature and condition of the ace bombarded, nature of the gas in the discharge , energy of the rays, time for which the bombardment s place, etc. Special experiments were carried out to idate the mechanism of the deposit formation and origin and development of the ring structure. The lts obtained are discussed and a mechanism suggested. A.

542 3227

leasurements on self-quenching Geiger–Müller coun- II. VAN GEMERT, A. G. M., DEN HARTOG, H., MULLER, F. A. *Physica, 's Grav.*, **9**, 658–64 (*July*, 2).—[See Abstr. 2621 (1946)]. A circuit has been eloped for the rapid and semi-automatic measurement otal charge passing through a counter. The pulse- /voltage characteristic can be obtained in a single tograph in a few secs. Resolving time can readily measured by making the counter pulses start an riodic time sweep, and a circuit for this is given. A. J. M.

.542 3228

ome properties of counters with beaded wires. CURRAN, , AND RAE, E. R. *J. Sci. Instrum.*, **24**, 233–8 (*Sept.*, 7).—The addition of fairly closely spaced beads to the e of a Geiger counter [Abstr. 1343 (1942)] has no ous effects on the length or flatness of the "plateau." e main action of the beads in preventing spread of the charge is traced to the reduction of field strength in the nity of the bead and no electrostatic charge need be oked since conducting beads are as efficient as non- ducting in securing localization. The variation in the ree of localization with over-voltage, nature of the gas ture and pressure is examined. The beads reduce the rall efficiency of the tube since they produce insensitive ions around themselves. The effective value of the d-time for a tube containing a wire with many beads o small that rates of counting of several thousands per ond are possible with small error. An anomalous ect produced by α-particles fired across a tube so as to ss close to the wire is examined. A.

7.542 3229

On self-quenching halogen counters. PRESENT, R. D. *ys. Rev.*, **72**, 243–4 (*Aug.* 1, 1947).—Applies the con- erations developed in a previous paper [Abstr. 2068 44)] to show that, under certain conditions, the logens are suitable quenching gases for fast G–M unters. L. E. M.

7.542 : 539.16.08 3230

Carbon dioxide filled Geiger–Müller counters. BROWN, C., AND MILLER, W. W. *Rev. Sci. Instrum.*, **18**, 496–9 *uly*, 1947).—Efficient detection of the long period C^{14} otope can be achieved when this isotope is oxidized to O_2 gas which may then be used as a G–M counter ing. The special problems which arise in CO_2 counters e discussed. O_2 ions produce undesirable effects which e eliminated by small amounts of CS_2. The result of e investigation has been to develop a CO_2–CS_2 counter nich has satisfactory properties for routine studies C^{14}. A.

537.542 : 539.165.08 3231

Quantitativity of Geiger-counters for beta-rays. MILATZ, J. M. W., AND VAN DER VELDEN, H. A. *Physica, 's Grav.*, **9**, 169–76 (*Feb.*, 1942).—An expression for the counts v. gas-pressure curve for a G–M counter is derived. This, when compared with an experimental case using β-rays, shows that the probability of a pulse following the formation of an ion-pair is unity. L. E. M.

537.542 : 621.318.57 : 519.24 *see Abstr.* 3004

537.56 : 536.48 : 537.531 *see Abstr.* 3218

537.56 : 537.523.5 = 393 *see Abstr.* 3210

537.561 : 538.691 : 542.9 *see Abstr.* 3344

537.568 : 537.523.4 3232

Electron/ion recombination in hydrogen spark discharges. CRAGGS, J. D., AND HOPWOOD, W. *Proc. Phys. Soc., Lond.*, **59**, 771–81 (*Sept.*, 1947).—The afterglows following short sparks in hydrogen at a pressure of 1 atmos. have been described earlier [Abstr. 2895 (1946)]. The present communication presents later results and a detailed analysis of the afterglows. It is shown that an electron/ion recombination process is apparently the cause of the light emitted in the afterglow. On this basis the appropriate coefficient of recombination has been calculated. The implications of the results, and relevant literature, are discussed. A.

537.581 3233

A simple and general extension of the three-halves power law. HAMAKER, H. C. *Physica, 's Grav.*, **9**, 135–8 (*Jan.*, 1942).—The following theorem is proved neglecting initial velocities. If all potentials are scaled by the factor f, all dimensions by the factor g and the current densities by $f^{3/2}g^{-2}$, the potential and current distributions remain unaltered. A. H. W. B.

COSMIC RAYS 537.591

537.591.1 3234

On the origin of the soft component of cosmic radiation. HEITLER, W., AND POWER, S. *Phys. Rev.*, **72**, 266–72 (*Aug.* 15, 1947).—The intensity of the soft component in the upper atmosphere is calculated on grounds of an improved version of an earlier theory [Abstr. 2834 (1943)], assuming that the soft component is produced by a short-lived meson which, along with ordinary mesons, is produced by primary protons. The position of the max. is largely influenced by the mean free path of the primary protons. The results (which are largely independent of the details of the theory), including the latitude effect, are in good agreement with the experiments, thus showing that the bulk of the soft component can be understood by this mechanism. The absence of the east-west effect must be explained by a large angular straggling. A.

537.591.1 = 5 3235

On the penetrating particles which accompany extensive showers. COCCONI, G., AND FESTA, C. *Nuovo Cim.*, **3**, 293–6 (*Oct.*, 1946) *In Italian.*—The showers are observed under 167 g/cm² of Pb and 120 g/cm² of brick. It is found that the penetrating particles are produced in the absorber and not in the atmosphere, and their number is the same for a given mass per unit area of absorber, whether of Pb or of brick. G. P. S. O.

537.591.1 = 5 3236

On the penetrating particles in extensive air showers. FERRETTI, B. *Nuovo Cim.*, **3**, 301–6 (*Oct.*, 1946) *In Italian.*—Assuming that the penetrating particles are mesons created by γ-rays, it is shown that the number of mesons under thick layers of absorbers of atomic number Z must $\propto Z$ or be constant if, respectively, the cross-

section of the process $\propto Z$ or Z^2. Since the first assumption is excluded by the experiment of Cocconi and Festa [Abstr. 3235 (1947)] and the second does not explain the large number of particles observed, it seems that either the penetrating particles are not mesons or, if they are, cannot be generated by the soft component.

G. P. S. O.

537.591.1 : 539.18 3237

Mean life of mesotrons at an altitude of 11 500 ft. TICHO, H. K. *Phys. Rev.*, **72**, 255–6 (*Aug.* 1, 1947).—The lifetime of each meson stopped in a 10 cm Al absorber was measured by comparison with the frequency of a quartz crystal at a height of 11 500 ft. A value of $\tau_0 = 1{\cdot}78 \pm 0{\cdot}10$ μsec was obtained. W. E. D.

537.591.15 3238

Showers of the soft cosmic radiation in Pb, Fe, and Al. CLAY, J., AND JONKER, K. H. J. *Physica, 's Grav.*, **7**, 921–36 (*Dec.*, 1940).—Variations of the Rossi curve for transition layers of Pb, Fe and Al were studied with particular reference to the number, size and horizontal disposition of the coincidence counters and to their vertical distance below the transition material. J. G. W.

537.591.15 3239

Burst production by penetrating cosmic-ray particles. BRIDGE, H., ROSSI, B., AND WILLIAMS, R. *Phys. Rev.*, **72**, 257–8 (*Aug.* 1, 1947).—Coincidence experiments between a tray of counters and a pressure ionization chamber separated by a 6-in Pb block show that, at 30 000 ft, the penetrating component contains particles much more effective than mesons in producing bursts, and it is suggested that these particles are primary "protons."

W. E. D.

537.591.15 = 3 3240

On the theory of cascade showers. I–II. BRUINS, E. M. *Physica, 's Grav.*, **8**, 988–1006 (*Nov.*, 1941); **10**, 130–40 (*March*, 1943) *In German.*—The theory of cascade showers is developed, following the treatment by Furry, with reference to the passage of an extended energy spectrum of electrons and photons through matter. Some features of the atmospheric soft component of cosmic rays are considered. J. G. W.

537.591.3 : 539.18 = 5 3241

On the anomalous absorption of the mesonic component near sea level. FESTA, C., SANTANGELO, M., AND SCROCCO, E. *Nuovo Cim.*, **1**, 71–84 (*April*, 1943) *In Italian.*—The ratio $\tau/\mu c^2$ of the mean lifetime of the meson to its rest energy is determined by the investigation of anomalous absorption. Mesons whose penetrating power is < 55 cm of Pb and > 15 cm are observed, at 60 and 960 m above sea level. The experiment gives a mean lifetime, for $\mu c^2 = 100$ MeV, of 3–4 μsec.

G. P. S. O.

MAGNETISM 538

538 : 521.038 : 523.87 *see Abstr.* 3032

538 : 530.12 = 4 *see Abstr.* 3046

538.082 : 621.317.42 = 397 3242

Method of determining force and torque of a magnet. PYÖKÄRI, T. *Kraft Ljus* (*No.* 3) 51–7 (*March*, 1947) *In Swedish.*—[Abstr. 2759 B (1947)].

538.082.1 3243

Magnetochemical investigations. VI. Additional notes on standardization and technique. ANGUS, W. R., AND TILSTON, D. V. *Trans. Faraday Soc.*, **43**, 235–8 (*May*, 1947).—Sources of error in calibration of the Gouy apparatus are critically examined and certain modified procedures are described. A.

538.082.1 : 538.12 324

Magnetochemical investigations. VII. Calculations o the magnetic field. TILSTON, D. V. *Trans. Farada Soc.*, **43**, 238–43 (*May*, 1947).—The calculation of curve relating field strength to the distance from the centre c the pole-gap is described for four types of pole-piec viz. point poles, line poles, square poles with the vertic (*a*) parallel to the side of the square and (*b*) parallel t the diagonal of the square.

538.082.1 : 538.124 324

Concerning the form of pole pieces in the measureme of magnetic susceptibilities. PACAULT, A. *C.R. Aca Sci., Paris*, **224**, 1500–2 (*May* 28, 1947) *In French.*— Curves of H^2 and of $\partial H^2/\partial x$ against x (the vertic distance from the centre of the gap) are given for th customary type of pole pieces and for specially shape pole pieces which are described. W. R.

538.113 324

Some further measurements on paramagnetic dispersio BROER, L. J. F. *Physica, 's Grav.*, **13**, 353–65 (*Aug* 1947).—After a recapitulation of the results of va Vleck's theory of the paramagnetic lattice relaxatio [Abstr. 1661 (1940)] new experimental data on th dispersion in various Cr salts are discussed in order t test this theory. It appears that the dependence of th relaxation constant on the magnetic field is given correctl by van Vleck but that the influence of temp. comes ou wrong. Finally it is shown that the paramagnetic dis persion in Fe alum is also at variance with theory, bu the results on Mn ammonium sulphate are in accordanc with van Vleck's expectations.

538.113 = 4 324

Diamagnetism of ions. PACAULT, A. *Rev. Sci., Pari* **84**, 169–91 (*Aug.*, 1946) *In French.*—A critical review c existing methods of deriving values for the diamagneti susceptibility of ions. W. R.

538.114 : 538.691 *see Abstr.* 2365

538.12 : 538.082.1 *see Abstr.* 3244–5

538.214 : 541.67 324

Magnetochemical investigations. V. The diamag netism of binary liquid mixtures. ANGUS, W. R., AN TILSTON, D. V. *Trans. Faraday Soc.*, **43**, 221–35 (*Ma* 1947).—The calculation of the apparent susceptibilit (χ_{2app}) of one component of a binary liquid mixture i discussed and a relationship between this value and th magnitude of deviations (χ_{dev}) from strictly additiv behaviour is derived. The change of susceptibility, a index of chemical or physical reaction in the mixture is given by $\Delta\chi_{2app} = \chi_{dev}/w_2$; 69 sets of publishe data have been examined, and the progressive type c deviation shown by all systems suggested that th behaviour arose from the method of calculation or mino inaccuracies in certain variables on which $\Delta\chi_{2ap}$ depends. The effect of these errors has been compute and indicates that the real magnitude of observe deviations is not readily ascertainable quantitatively a present. A

538.221 324

On the temperature magnetic hysteresis in ferromagneti materials. SCHUR, J. S., AND DROZHINA, V. I. *C.R Acad. Sci. URSS*, **56** (*No.* 1) 39–42 (1947).—Th dependence of magnetization on temp. for temp. cycle between −195°c and 400°c has been investigated for N and 4% Si iron. The observed hysteresis is explaine qualitatively in terms of the change with temp. of th spontaneous magnetization and of displacements of th boundaries between domains caused by changes in th values of the constants of anisotropy and magnetization.

A. E. D. B

21 = 4 3250

riation of the coercive force as a function of the ty of agglomerated ferromagnetic powders. WEIL, L. *Acad. Sci., Paris*, **225**, 229–30 (*July* 28, 1947) *In h.*—The coercive force of agglomerates of iron and -cobalt powders of different densities is shown to linearly with the density. The extrapolated values ero density agree with the theoretical values if the lers are carefully prepared. A. E. D. B.

21 : 539.4.016.2 : 539.26 *see Abstr.* 3316

21 : 621.318.22 = 4 3251

eory of the anisotropy of certain magnet steels heat- ed in a magnetic field. NÉEL, L. *C.R. Acad. Sci.*, , **225**, 109–11 (*July* 16, 1947) *In French.*—In two- e alloys, crystallites of the magnetic phase would to assume a shape elongated || to the field, and thus a lower demagnetizing factor in this direction than it. Estimates of the interface energy for the two es of Alnico v are of the right order to explain the rved anisotropy. Magnetostriction effects pre- sly suggested are too small by a factor of 100. A. J. C. W.

222 3252

e magnetic susceptibilities of copper potassium sul- e hexahydrate. HUPSE, J. C. *Physica, 's Grav.*, **9**, 40 (*July*, 1942).—The 3 principal magnetic suscepti- ies of $CuSO_4 . K_2SO_4, 6H_2O$ have been determined 1·5° to 290°K. The Curie law is followed with ent constants in different directions. Their average e agrees with that derived by Reekie for the pow- d salt. From demagnetization experiments it is luded that the magnetism is due to a doubly degenerate st level of the Cu·· ion and in this respect the ion vs a "spin only" behaviour. The value of the neton number > a "spin only" case, probably owing pin-orbit interaction. W. R. A.

222 = 4 3253

easurement of the principal susceptibilities of potas- ferricyanide at temperatures higher than ordinary perature. MASSON, H. *C.R. Acad. Sci., Paris*, **224**, 7–8 (*May* 5, 1947) *In French.*—The susceptibilities e been measured up to 410°K. Curie constants are ved and compared with values given by Jackson str. 3857 (1938)]. W. R. A.

222 : 536.48 3254

itial susceptibility of $Gd_2(SO_4)_3 . 8H_2O$ between 5°K and 1·0°K. VAN DIJK, H. *Physica, 's Grav.*, **9**, -36 (*July*, 1942).—Measurements were made from 5°K to 1·0°K and found to agree better with the ories of van Vleck and of Onsager than with that of ntz. D. S.

.222 : 538.614 : 548.0 3255

he magnetic susceptibilities of a single crystal of seodymium ethylsulphate. VAN DEN HANDEL, J. *mun. K. Onnes Lab. Leiden* (*No.* 263*a*). *Physica, Grav.*, **8**, 513–21 (*June*, 1941).—Measurements of the ceptibilities of a single crystal of $(EtSO_4)_3Pr, 9H_2O$ ⊥ . || to the axis are given and compared with magnetic ations of the plane of polarization || to the axis of a ilar crystal. The agreement is satisfactory and the allelism between the values upholds the theory of . Vleck and Hebb. The spectrographic work of Merz iscussed. W. R. A.

.222 : 548.0 3256

he magnetic susceptibilities of a single crystal of dymium ethylsulphate. VAN DEN HANDEL, J., AND PSE, J. C. *Physica, 's Grav.*, **9**, 225–32 (*Feb.*, 1942).— gnetizations in two directions have been measured for crystals of $(EtSO_4)_3Nd, 9H_2O$ between 1·5° and 290°K. The paramagnetic rotation of the plane of polarization is approx. proportional to the magnetization in agreement with the theory of van Vleck and Hebb. Anisotropies have been compared with those determined by Fereday and Wiersma and differences may be accountable for by irreproducibilities in the crystals. W. R. A.

538.222 : 548.0 3257

On the theory of the paramagnetic anisotropy of some hydrated cupric salts. POLDER, D. *Physica, 's Grav.*, **9**, 709–18 (*July*, 1942).—In $CuSO_4, 5H_2O$ the complex formed by Cu·· and its six neighbours has nearly tetragonal symmetry. In $K_2Cu(SO_4)_2, 6H_2O$ it seems likely that tetragonal $Cu^{··}(H_2O)_6$ clusters occur. Thus, in each salt the unit cell contains differently orientated and nearly identical tetragonal groups. Observed anisotropies can be explained by assuming that the salts contain magnetically uniaxial Cu·· ions with Curie constants of 0·56 in the direction of the tetragonal axis and 0·40 in a direction at 90° to this axis. A tetragonal crystal field acting on the ion accounts for the values. W. R. A.

538.23.08 : 621.317.43 : 538.54 *see Abstr.* 3262

538.24 : 536.7 : 536.48 *see Abstr.* 3185

538.245 3258

The determining factors of permeability. SNOEK, J. L. *Physica, 's Grav.*, **8**, 344–6 (*March*, 1941).—Recent measurements, whilst confirming that the magnetic properties of well-annealed materials can be explained in terms of magnetostrictive strains and crystal anisotropy alone, suggest that some other factor is also involved in the case of cold-worked materials. A. E. D. B.

538.245 = 4 3259

Properties of a finely-powdered ferromagnetic of cubic structure. NÉEL, L. *C.R. Acad. Sci., Paris*, **224**, 1488–9 (*May* 28, 1947) *In French.*—Gives the theoretical basis for the existence of a critical particle size below which magnetization takes place not by domain boundary shifts but by rotation of direction of spin axes. Limiting diameter is calculated as 320 Å, and the production of powders with grains of this order and showing high coercive force is quoted. N. F. A.

538.245 = 4 3260

Coercive force of ferromagnetic powders with ellipsoidal particles [à grains anisotropes]. NÉEL, L. *C.R. Acad. Sci., Paris*, **224**, 1550 (*June* 2, 1947) *In French.*—Considers the properties of an aggregate of ellipsoidal particles of ~ critical size [Abstr. 3259 (1947)] and shows that, since the demagnetizing coefficient differs for the different axes of the particles, the grains will show anisotropy quite apart from that due to crystal structure (which is relatively unimportant in any case for particles < the critical size). This leads to hysteresis, and a calculated value of 500 oersted is given for the coercive force of a compressed aggregate, in agreement with experiments. N. F. A.

ELECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

538.3 : 530.145 *see Abstr.* 3064

538.54 : 536.21 : 621.365.5 = 4 3261

Induction heating of a thin disc normal to a magnetic field. RIBAUD, G. *J. Phys. Radium* (*Sér.* 8) **7**, 1–7 (*Jan.*, 1946) *In French.*—[Abstr. 2805 B (1947)].

538.54 : 538.23.08 : 621.317.43 3262

The influence of eddy currents on the apparent hysteresis loop of ferromagnetic bars. SNOEK, J. L. *Physica, 's Grav.*, **8**, 426–38 (*April*, 1941).—It is shown that in

magnetic measurements on straight bars in which the field is changed quickly the shielding effect of eddy currents may cause the outer parts of the bar to assume for a short time a much higher magnetization than the final value. In extreme cases the measured value of the coercive force may be in error by a factor of 2 and the error in the hysteresis loss may be much larger.

A. E. D. B.

538.56 = 4 3263

Reaction due to radiation. REULOS, R. *C.R. Acad. Sci., Paris*, **225**, 100–2 (*July* 16, 1947) *In French.*—A method of solving Maxwell's equations is used to calculate the reaction on a radiating aerial in two simple cases.

G. J. K.

MAGNETIC EFFECTS 538.6

538.612 : 535.515 = 4 *see Abstr.* 3159

538.614 = 4 3264

Magnetic rotativities. DE MALLEMANN, R. *Ann. Phys., Paris*, **18**, 56–72 (*Jan.–March*, 1943) *In French.*—[See Abstr. 929 (1947)]. The rules governing the additivity of magnetic susceptibility, specific refractivity, specific rotativity, specific rotatory power, and refringent power in mixtures have been investigated with respect to the behaviour of magnetic rotativity. Certain results obtained by Guillaume using a magnetic polarimeter have been used in an attempt to elucidate the magnetic rotatory properties of the ions in a solution of an electrolyte. The main problem is the choice of a term which will express the specific properties of the dissociated compound at each concentration. The discussion is extended briefly from the consideration of ions, independent through complete dissociation, to those in which association has taken place. W. R. A.

538.614 : 548.0 : 538.222 *see Abstr.* 3255

538.65 : 539.312 = 4 *see Abstr.* 3324

538.691 : 537.561 : 542.9 *see Abstr.* 3344

538.691 : 538.114 3265

The deflection of charged particles in a ferromagnetic medium. WANNIER, G. H. *Phys. Rev.*, **72**, 304–12 (*Aug.* 15, 1947).—The deflection is recomputed which a beam of charged particles will undergo when penetrating a ferromagnetic medium whose magnetism is due to electronic spins. The extreme importance of the "interior of the electron" for the effective magnetic field **b** is brought out by a quantum calculation which is analogous to well-known classical considerations. Only if the interpenetration of beam particle and electron has random probability will one find $\mathbf{b} = \mathbf{B}$. Otherwise deviations are to be expected which can be estimated in special cases. A section is added which develops the conditions under which magnetic deflection can be observed in competition with multiple scattering. Very high energy protons and deuterons offer the best possibilities. A.

538.691 : 539.165.08 3266

Magnetic focusing between inclined plane pole-faces. RICHARDSON, H. O. W. *Proc. Phys. Soc., Lond.*, **59**, 791–804 (*Sept.*, 1947).—Electron orbits have been computed in the magnetic field between inclined equipotential plane pole-faces. The field, if applied to β-ray spectroscopy, should give high dispersion and resolving power combined with a fair solid angle of collection Ω. In a particular case, Ω is estimated to be $16{\cdot}5 \times$ that of a conventional semi-circular spectrograph of similar dimensions. If the inclined planes are bevelled so as to become parallel at their closest parts, both lateral and longitudinal focusing should occur. This case is treated approximately, and it seems probable that, althou aberrations may reduce the resolution below that giv by the first method, high values of Ω ($\sim 0{\cdot}04\,\pi$) may obtainable.

ATOMIC AND MOLECULAR STRUCTURE 5

539.1 : 537.311.1 32

On the calculation of the energy of a Bloch wave ir metal. KORRINGA, J. *Physica, 's Grav.*, **13**, 392–4 (*Aug.*, 1947).—General formulae for the calculation the energy $E(\mathbf{k})$ of a Bloch wave with reduced wa vector **k** are obtained by the application of the dynami theory of lattice interferences to electron waves. T method requires the computation of the zeros of infinite determinant which in fair approximation mi be replaced by a determinant with a few rows a columns only. Its elements are the sum of two functio a function of E and **k**, resulting from interference multipole waves of free electrons (and therefore dependent of the lattice potential), and a function of only, resulting from scattering of free electron waves the field around one atom. Of the latter terms only th in the principal diagonal are of importance.

539.1 : 537.311.1 : 548.0 32

On the bands of conduction electrons in the tungst crystal. COSTER, D., AND DE LANG, H. *Physica, Grav.*, **13**, 385–91 (*Aug.*, 1947).—The energy differer between the X-ray levels L_I and L_{III} of W as calculat from the frequency of emission lines ($L_I - L_{III} = \nu_{M\gamma} + \nu_{M\gamma} - \nu_{L\beta_2}$) is about 7 V < the energy differer between the L_I and L_{III} absorption edges. This has be interpreted by assuming that the unoccupied electr levels of lowest energy in the W crystal are nearly exc sively of the *d*-type, whereas the lowest unoccupi *p*-type electron levels have ~ 7 V more energy.

539.11 32

On a simple statistical property of an ensemble of lin harmonic oscillators. KRONIG, R. *Physica, 's Grav.*, 113–16 (*Jan.*, 1942).—The mean-square displacement a wave-mechanical linear harmonic oscillator at ten T°K is $\delta^2 = (h/4\pi^2\nu m)\coth h(h\nu/kT)$ (m = mass, ν = f quency). The mean-square displacement of an atom a solid at sufficiently low temps. is the sum of those the lattice vibrations. The distribution is Gaussian.

A. J. C.

539.11 : 548.7 *see Abstr.* 3356

539.13 : 535.343–15 = 4 32

Interpretation of the harmonic and combination ban of the infra-red spectrum of tetrachlorethylene. DUCHES J. *Physica, 's Grav.*, **8**, 144–8 (*Jan.*, 1941) *In French.*

539.13/.15 32

Model to demonstrate oscillations in a molecule su jected to an electric field. MADDOCK, A. J. *J. S Instrum.*, **24**, 230–2 (*Sept.*, 1947).

539.132 32

The non-spherical potential field between two hydrog molecules. DE BOER, J. *Physica, 's Grav.*, **9**, 363– (*March*, 1942).—A perturbation method is applied to t calculation of the repulsive interaction energy. Van c Waals' attractive field and that due to the quadrup moment are also evaluated. The total theoretical fi agrees with the "experimental" field obtained from t experimental values of the second virial coefficient. L.

539.132 = 4 32

The potential function for plane motions of molecul of type X_2YZ, with application to the thiophosge molecule. DUCHESNE, J. *Physica, 's Grav.*, **8**, 525–

e, 1941) *In French.*—The potential introduced is ed to square terms in the plane deformations, and ains both valence forces and deformation forces. normal frequencies of oscillation are expressed as tions of the parameters appearing in the potential tion and evaluated numerically for the $CSCl_2$ ecule. L. P.

132 : 533.7 = 3 *see Abstr.* 3092

132 : 541.57 3274

ne electronic structure of conjugated systems. I. eral theory. COULSON, C. A., AND LONGUET-GINS, H. C. *Proc. Roy. Soc. A*, **191**, 39–60 (*Sept.* 26, ').—This paper develops the general theory of ugated systems by the method of molecular orbitals. electron densities and bond orders appear as first- r derivatives of the energy of the mobile electrons respect to the energy integrals in the secular equa- ; and various other relations are established which irm the appropriateness of the definitions. A set of quantities is introduced and discussed for the first namely, the mutual polarizability of two atoms or bonds or an atom and a bond, and it is shown that are important in determining the effect of structural nges on chemical reactivity, and also in calculating e constants and interaction terms for the vibration of ds. Formulae are derived for the calculation of the l energy, electron densities, bond orders and mutual rizabilities, and the relation of these quantities to er physical and chemical properties is briefly dis- ed. A.

.133 3275

n the dipole moment of ammonia. POLDER, D. *mmun. K. Onnes Lab. Leiden* (*Suppl. No.* 92*c*). *sica, 's Grav.*, **9**, 908–14 (*Nov.*, 1942).—Symmetrical molecules present the so-called $\pm K$ degeneracy, but is removed in NH_3 because the N-atom has two ilibrium positions. The two resulting levels have no ole moment, but a Stark effect is found. Scheffers' eriments [*Phys. Z.*, **41**, 89, 98 (1940), **43**, 6 (1942)] discussed and re-interpreted. L. P.

.133 : 535.343.3 = 4 3276

lew investigations on the potential function for the ar vibrations of C_2Cl_4. DUCHESNE, J. *Physica, 's v.*, **9**, 249–66 (*Feb.*, 1942) *In French.*

.133 : 535.343.4–15 *see Abstr.* 3135

.133 : 539.152.2 : 535.343.4–14 *see Abstr.* 3132–4

.133 : 541.57 = 4 3277

Determination of the binding constant of the $C_6H_5 - X$ nd in singly substituted benzene derivatives. BARRIOL, AND CHERRIER, C. *C.R. Acad. Sci., Paris*, **224**, 6–7 (*June* 16, 1947) *In French.*—One line of the spec- m is attributed to vibration in the line of the bond $H_5 - X$. (785 cm^{-1} for toluene). The potential and etic energies of deformation are calculated for this with the aid of accepted values for the elastic nstants of the benzene ring itself, the value for the stituted bond is calculated. Although only 29% of energy is due to this bond, good agreement with a ferent method is obtained. C. F. B.

.133 : 548.0 *see Abstr.* 3350

.133 : 548.7 : 535.343.2–15 = 4 *see Abstr.* 3125

.152.1 3278

The binding energies of very light nuclei. FRÖHLICH, H., JANG, K., AND SNEDDON, I. N. *Proc. Roy. Soc. A*, l, 61–82 (*Sept.* 26, 1947).—The static interaction of Møller-Rosenfeld theory is used to calculate approxi- tely the binding energies of the nuclei H^2, H^3, He^3 and He^4. The value of the meson mass and of the two other parameters available in the theory are determined from a comparison with the observed binding energies of the H^3 nucleus and of the singlet and triplet states of the deuteron. The meson mass so determined is between 210 and 220 electron masses. The binding energy of He^3 calculated from the energy difference $H^3 - He^3$ is found to be in fair agreement with the observed value. The theoretical binding energy of $He^4 < \frac{1}{3}$ the observed value, and it is suggested that in this nucleus there exists an additional many-body interaction. A.

539.152.1 3279

Interpretation of the triton moment. SACHS, R. G. *Phys. Rev.*, **72**, 312–20 (*Aug.* 15, 1947).—In order to account for the measured magnetic moment of the triton it is necessary to assume that the wave function in the ground state is a linear combination of ^2S, ^2P, ^4P, and ^4D functions. An attempt is made to determine the amplitudes of these functions from the magnetic moment on the assumption that the intrinsic nucleon moments are additive and relativistic effects are negligible. With certain reasonable assumptions concerning the nature of the wave functions, it is found that the relative probabilities for finding the system in the ^2P, ^4P, and ^4D states satisfy a relation shown by curves. Wherever the results would otherwise be arbitrary, the wave functions have been chosen in such a way as to minimize the amount of P state, with the exception that only the lowest one-particle configurations have been considered. If the amplitude of the ^2S state is taken to be as large as possible, the wave function contains no ^4D state, 8% ^4P state, and 17% ^2P state. A wave function of this form would seem to indicate that there is a spin-orbit coupling other than the tensor interaction acting among nuclear particles. In the other extreme case that the wave function contains a max. of the ^4D function, the ^2S state probability is zero, the ^4D probability is 22%, the ^4P is 30%, and the ^2P is 48%. Curves for the He^3 moment are given, on the assumption that the wave function of He^3 has the same form as that of H^3. A.

539.152.1 = 4 3280

Stability of heavy nuclei. GUEUTAL, P., AND DAUDEL, R. *Rev. Sci., Paris*, **84**, 109–13 (*June–July*, 1946) *In French.*—A domain is constructed with mass number, A, and atomic number, Z, as axes, which should include all isotopes with $\frac{1}{2}$-lives > 1 sec. It is shown that all the known atoms are included in this domain. Deductions are made as to the regions where further isotopes are to be discovered, and the upper limits of A and Z are discussed. W. E. D.

539.152.1 = 4 3281

Gamow theory of the nuclear potential barrier. PONSONNET, P. *Rev. Sci., Paris*, **84**, 236–40 (*Sept.* 1, 1946) *In French.*—A summary is given of the theory and of various experimental results relevant thereto. W. E. D.

539.152.1 : 537.534.74 3282

Proton-proton scattering at 10 MeV. PEIERLS, R. E., AND PRESTON, M. A. *Phys. Rev.*, **72**, 250 (*Aug.* 1, 1947). —A comparison of theory with experiment [Abstr. 1543–4 (1947)] leads to a value of $K_0 = 52°30'$ for the S-phase, and $K_1 = -0·8°$ for the P-phase, which is in disagreement with the scattering at 14·5 MeV. The results agree with the assumption that the nuclear forces are mainly of the Majorana and Heisenberg type. W. E. D.

539.152.1 : 537.534.74 = 3 *see Abstr.* 3225

539.152.2 3283

On the magnetic octupole moment of a nucleus. CASIMIR, H. B. G., AND KARREMAN, G. *Physica, 's*

Grav., **9**, 494–502 (*May*, 1942).—Tolansky [Abstr. 1661 (1939)] observed hyperfine separations in I depending on the third power of the Landé factor. This may be explained in terms of a magnetic octupole moment of the nucleus, though simple considerations indicate that this should be too small to lead to measurable effects. In the present paper the value of the octupole moment which would give an effect of the order of magnitude found by Tolansky is calculated more accurately and found to be at least 100 × > any value that a reasonable picture of the nucleus could give. L. P.

539.152.2 3284

On the magnetic exchange moment for H^3 and He^3. Villars, F. *Phys. Rev.*, **72**, 256–7 (*Aug.* 1, 1947).—The recent experimental results giving a value for the magnetic moment of H^3 > that of H^1 is in disagreement with the theoretical results of Sachs and Schwinger [Abstr. 2931 (1946)]. Using the symmetrical pseudoscalar meson theory, reasonable agreement is obtained by using reasonable values of parameters. W. E. D.

539.152.2 3285

Nuclear moments of the bromine isotopes. Brody, S. B., Nierenberg, W. A., and Ramsey, N. F. *Phys. Rev.*, **72**, 258–9 (*Aug.* 1, 1947).—The magnetic moments of the two isotopes [not distinguished] are 2·110 ± 0·021 and 2·271 ± 0·023 nuclear magnetons. W. E. D.

539.152.2 : 539.133 : 535.343.4–14 *see Abstr.* 3132–4

539.153 3286

The electronic excitation-function of the metastable 2^3S-level of helium. Woudenberg, J. P. M., and Milatz, J. M. W. *Physica, 's Grav.*, **8**, 871–84 (*Sept.*, 1941).—The concentration of metastable He atoms in an excitation tube is measured by an absorption method at various potentials and pressures. The dependence on p is parabolic, and this may be explained as a diffusion effect. The absolute efficiency at 60 V and 0·06 mm pressure is 0·09. L. P.

539.153 3287

On the hyperfine structure of the ground state of H and D atoms. Halpern, O. *Phys. Rev.*, **72**, 245–6 (*Aug.* 1, 1947).—A more rigorous theoretical treatment of this problem is given using Dirac functions throughout. This reduces, but does not eliminate, the discrepancies between experiment and theory recently reported [Abstr. 2614 (1947)]. W. E. D.

539.153 : 537.533 = 3 3288

The electronic emission from metals by impact of metastable atoms, applied to the determination of excitation functions. Dorrestein, R. *Physica, 's Grav.*, **9**, 433–46 (*May*, 1942) *In German.*—Metastable atoms produced by a beam of slow electrons hit a Pt plate and liberate electrons from it; excitation functions can be determined from a measurement of the electronic current. Charged particles are kept away from the plate by means of suitable fields. The effect of photons can be separated by applying an alternating potential, as the velocity of the metastable atoms is small. L. P.

539.153 : 537.533 = 3 3289

Excitation-functions for metastable states in helium and in neon, determined from the electronic emission from metals due to the impact of the metastable atoms. Dorrestein, R. *Physica, 's Grav.*, **9**, 447–60 (*May*, 1942) *In German.*—An application of the method described in Abstr. 3288 (1947). In He two maxima may be distinguished in the excitation function: The efficiency of electron emission by metastable atoms is about 0·24 for 2^3S-atoms and 0·40 for 2^1S-atoms. With Ne this efficiency is about 0·12. L. P.

539.155.2 329

The isotope distribution program. *Science*, **106**, 175– (*Aug.* 29, 1947).—This report of the Isotopes Branch U.S. Atomic Energy Commission, covers the period fro June 14, 1946. The distribution and composition shipments (1101) are analysed, and some of the uses which they have been put are outlined. Improvemen in availability, and some newly available isotopes, a announced. Stable isotopes (D, B^{10}, O^{18}) are als included in the report.

539.155.2 : 533.15 : 536.46 = 3 *see Abstr.* 3182

539.155.2 : 541.123.59 = 4 *see Abstr.* 3332–3

RADIOACTIVITY . NUCLEAR DISINTEGRATIO NUCLEAR PARTICLES 539.16/.18

539.16.08 329

An improved Geiger-counter arrangement for determina tion of radium content. Davis, F. J. *J. Res. Nat. Bu Stand., Wash.*, **38**, 513–18 (*May*, 1947).—Apparatus which several counters may be placed in any positio relative to each other is described. A circular arrang ment of counters to give a counting rate approximatel independent of the position of a source near the centre the circle is discussed. The relation of the position of th source to the counting rate of a single counter is discusse A method of calculation of the self-absorption of sample for the arrangement used is given.

539.16.08 : 537.542 *see Abstr.* 3230

539.16.08 : 545.8 = 4 329

On the possibility of studying the activity of rocks b observing alpha ray tracks in photographic emulsion Curie, I. *J. Phys. Radium* (*Sér.* 8) **7**, 313–19 (*Nov* 1946) *In French.*—An analysis of the number of rays t be expected from rocks containing very small quantities U and Th is given. Possible deductions from the resul are indicated. It is concluded that the method may gi results not obtainable by other methods but that applica tion of it will be difficult. G. O. I

539.16.08 : 614.898 *see Abstr.* 3393

539.16.08 : 621.318.572 329

Portable Geiger–Müller counters. Hushley, W., an Feldman, K. *Canad. J. Res. F.*, **25**, 226–35 (*Ma* 1947).—[Abstr. 2785 B (1947)].

539.162 329

The $(4n + 1)$ radioactive series: the decay products U^{233}. Hagemann, F., Katzin, L. I., Studier, M. H Ghiorso, A., and Seaborg, G. T. *Phys. Rev.*, **72**, 25 (*Aug.* 1, 1947).

The $(4n + 1)$ radioactive series. English, A. C Cranshaw, T. E., Demers, P., Harvey, J. A., Hinck E. P., Jelley, J. V., and May, A. N. *Phys. Rev.*, **7** 253–4 (*Aug.* 1, 1947).—Both these letters give very simil results for the modes of disintegration and ½-lives of th various members and the energies of the emitted particle Both suggest the name "Neptunium Series." W. E. I

539.163 329

On the nuclear isomerism of $^{104}_{45}$Rh. Sizoo, G. J., an Friele, L. F. C. *Physica, 's Grav.*, **10**, 57–64 (*Jan.–Feb* 1943).—From studies of absorption in Al of the radiatio emitted from Rh activated by slow neutrons, it is show (*a*) that a soft γ-ray of ~ 50 keV is emitted when isomer Rh^{104*} goes to the ground state; (*b*) that a second γ-ra of ~ 400 keV, sometimes accompanies the β-transitio from the ground state to Pd^{104}. A. P.

539.163 329

β-ray spectrum of C^{14}. Levy, P. W. *Phys. Rev.*, 7

Aug. 1, 1947).—There is only one β-component with x. energy of 0·154 MeV, and no γ-ray was detected. W. E. D.

163 3297

isintegration scheme of Sc^{46}. PEACOCK, C., AND KINSON, R. G. *Phys. Rev.*, **72**, 251–2 (*Aug.* 1, 1947).— groups of β-rays were found with max. energies ± 0·01 and 1·49 ± 0·01 MeV and relative fre- cies of 94% and 6% respectively. The softer com- nt is followed by two γ-rays in cascade, with energies ± 0·02 and 1·12 ± 0·02 MeV. It is suggested that softer γ-ray is internally converted with a coeff. of 01. A level diagram is given. W. E. D.

163 3298

ecay scheme of Sb^{124}. MEYERHOF, W. E., AND ARFF-GOLDHABER, G. *Phys. Rev.*, **72**, 273–5 (*Aug.* 15, ').—The β- and γ-rays emitted by 60-day Sb^{124} have investigated with the help of Geiger-counter icidences. The hard β-ray of 2·4 MeV is followed by γ-ray, while the soft β-ray of 0·7 MeV is followed by γ-rays. The intensity ratio of the hard to the soft ys $\simeq$ 1 : 1. A.

163 = 3 3299

he excitation energies of the isomeric states of rhodium and 104. FLAMMERSFELD, A., AND BRUNA, O. *Naturforsch.*, **2a**, 241–4 (*May*, 1947) *In German.*— vas found that Rh^{104*} decayed entirely to Rh^{104}, by emission of a totally converted γ-ray. From the rgy of the electrons the excitation energy of Rh^{104*} deduced to be 87 keV above the ground state [but Abstr. 2223 (1947)]. The excitation energy of Rh^{103*} found by a similar investigation to be 42 keV. A. P. F.

.164.1 : 537.133 : 778.3 3300

A study of the nuclear transmutations of light elements the photographic method. LATTES, C. M. G., FOWLER, H., AND CUER, P. *Proc. Phys. Soc., Lond.*, **59**, 883–900 pt., 1947).—A full account of work reported earlier ostr. 2967 (1947)]. The transmutation of Li, Be, B l O by 900 keV deuterons was studied. A hitherto observed group from Be was observed, attributed to otons formed by $Be^9(d, p)Be^{10*}$, the excited state having rgy 3·4 ± 0·08 MeV. A.

.164.75 3301

The stopping power of a metal for alpha-particles. AMERS, H. A. *Commun. K. Onnes Lab. Leiden ppl.* 96*a*). *Physica, 's Grav.*, **13**, 401–12 (*Aug.*, 47).—[Abstr. 150 (1947)]. The experimental fact that stopping power of a metal is independent of the ctric conductivity can be explained on classical Bohr ory by taking the polarization due to the conduction ctrons in the metal into account. A formula for the ergy loss per cm path of the α-particle is deduced. marks are made on the influence of the modifications quired by quantum mechanics. A.

9.165 : 545.8 3302

Correcting for the absorption of weak β-particles in thick mples. YANKWICH, P. E., NORRIS, T. H., AND HUSTON, *Industr. Engng Chem.* (*Analyt. Edit.*) **19**, 439–41 uly, 1947).—Methods are given for the construction of curve relating apparent specific activity to thickness sample, by means of which a correction for self- sorption can be applied to measurements made with sample of given thickness. Data are presented for $BaC^{14}O_3$; geometry of the measuring apparatus is scussed.

9.165.08 : 537.542 *see Abstr.* 3231

9.165.08 : 538.691 *see Abstr.* 3266

539.165.2 3303

The β-spectrum. VAN DER HELD, E. F. M. *Physica, 's Grav.*, **8**, 196–208 (*Feb.*, 1941).—It is shown that a linear combination of the Fermi theory and the Konopinski Uhlenbeck modification gives better agreement with experiment. The parameter involved in this combination is found to $\propto$ the atomic mass of the disintegrating nucleus. A modified Kurie plot is then made and it is possible to separate out two or more components of a complex spectrum. The results of such an analysis are tabulated for a number of elements. W. E. D.

539.17 3304

Thresholds for creation of particles. FESHBACH, H., AND SCHIFF, L. I. *Phys. Rev.*, **72**, 254 (*Aug.* 1, 1947).— A formula is deduced from purely energetic considerations for the bombarding energy needed for a particle of given mass to create given particles in collision with a given nucleus. Some examples are worked out. The thresholds are low for a heavy bombarded nucleus only if it does not disintegrate, which is shown to be unlikely. The reduction of threshold due to kinetic energy of nucleons in the bombarded nucleus is estimated.

539.172.4 = 4 3305

Range in aluminium of the radio-elements Zr 17 hr, Te 77 hr, Mo 67 hr, emitted in the fission of uranium. SUZOR, F. *J. Phys. Radium* (*Sér.* 8) **8**, 39–44 (*Feb.*, 1947) *In French.*—Ranges have been measured using a technique already described [Abstr. 2243 (1947)]. The relative amounts of Zr, Te and Mo formed in fission are deduced from the measurements; the energies of their β-radiations, as found by absorption in Al, are also given. A. P. F.

539.18 3306

Nuclear capture of mesons and the meson decay. PONTECORVO, B. *Phys. Rev.*, **72**, 246–7 (*Aug.* 1, 1947).— Recent experiments [Abstr. 1313 (1947)] on the nuclear capture of mesons are in disagreement with current theories; as a consequence the following suggestions are made: (*a*) that β-decay is described by the usual Fermi process without mesons; (*b*) that a meson has a spin $\frac{1}{2}\hbar$; (*c*) that it disintegrates by the emission of an electron and photon, or by the emission of an electron and 2 neutrinos; (*d*) nuclear absorption of a meson would be accompanied by the emission of a neutrino; (*e*) that mesons are most likely to be produced in pairs. W. E. D.

539.18 3307

On the change of the mean life of negative mesotrons. TICHO, H. K., AND SCHEIN, M. *Phys. Rev.*, **72**, 248–9 (*Aug.* 1, 1947).—Owing to the possible nuclear capture of negative mesons, the electrons produced by decaying negative mesons should arise from a decay constant different from a pure disintegration process. Disintegration curves are given assuming both negative and positive mesons present, and various values are taken for the capture probability of the negative mesons. W. E. D.

539.18 3308

Meson production. HORNING, W., AND WEINSTEIN, M. *Phys. Rev.*, **72**, 251 (*Aug.* 1, 1947).—The McMillan–Teller expression [Abstr. 2649 (1947)] is not valid near the threshold, and the problem is studied by making the perturbation calculation near threshold. W. E. D.

539.18 : 537.591.1 *see Abstr.* 3237

539.18 : 537.591.3 = 5 *see Abstr.* 3241

539.185 3309

On the inelastic scattering of neutrons in crystals. HALPERN, O. *Phys. Rev.*, **72**, 260–1 (*Aug.* 1, 1947).— The study of transmission of neutrons through a single crystal of Fe in a transverse magnetic field is suggested.

Incoherent scattering will be produced by a number of effects, the only one to be effected by the magnetic field being the inelastic lattice scattering. W. E. D.

539.185.7 3310

The resonance levels for neutron capture of silver, copper and zinc. COSTER, D., DE VRIES, H., DIEMER, G., AND NOTEBOOM, P. *Physica*, *'s Grav.*, **8**, 825–50 (*Sept.*, 1941).—Correction Abstr. 1646 (1947). Using the self-absorption and B absorption methods, the positions and widths of the neutron capture levels have been studied. For Cu and Zn the self-absorption curves do not agree with those calculated for a one-level Breit–Wigner formula. The existence of two or more levels is inferred. For Ag a single level at 6·5 eV, of width 0·42 eV, is found [but see Abstr. 1317 (1947)]. A. P. F.

539.185.7 3311

Resonance neutron capture in aluminium. SIZOO, G. J., AND EIJKMAN, C. *Physica*, *'s Grav.*, **8**, 868–70 (*Sept.*, 1941).—It was found that a few % of the 2·3 min neutron capture activity of Al was due to neutrons not markedly absorbed by Cd. Using a point fast-neutron source embedded in paraffin, the space distributions of the partial Al activities due to thermal and resonance neutrons were compared. It was concluded that the resonance neutrons had about the same energy as those undergoing resonance capture in I. A. P. F.

539.185.9 3312

The radiation excited by slow neutrons in cadmium. VAN HEERDEN, P. J., AND NINCK-BLOK. *Physica*, *'s Grav.*, **10**, 13–16 (*Jan.–Feb.*, 1943).—An investigation is described which failed to reveal the soft β-radiation which Pontecorvo [Abstr. 434 (1939)] reported as following slow neutron capture in Cd. A. P. F.

STRUCTURE OF SOLIDS 539.2

539.21 : 532.623 : 548.713 *see Abstr.* 3358

539.211 3313

Brittle rupture of plastic material. VAN ITERSON, F. K. T. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 3) 246–51 (1947).—The paper discusses theoretically the possibility of brittle explosive-like fracture in a plastic material such as mild steel. A photograph of brittle fracture in a mild steel girder is given. L. G. C.

539.23 : 548.0 = 3 3314

Optical investigations of the surface films on aluminium. HUBER, K., AND GAUGLER, A. *Experientia*, **3** (*No.* 7) 277–8 (1947) *In German.*—On {100} the electrolytic oxide layer is uniaxial with the axis perpendicular to the surface. On other faces the film is biaxial; a stereographic projection showing the axial planes is reproduced. A. J. C. W.

539.26 3315

The texture of copper wire drawn with backpull. CUSTERS, J. F. H. *Physica*, *'s Grav.*, **13**, 366–78 (*Aug.*, 1947).—The preferred orientations of Cu wire drawn in the normal way and with backpull respectively were investigated with X-rays. In the outer zones these orientations show distinct differences. In wire drawn with backpull the so-called conical fibre texture which predominates especially in the outer zones has developed less intensively than in wire drawn in the normal way. It is, however, still an open question whether properties like tensile strength are improved to a significant degree. A.

539.26 : 539.4.016.2 : 538.221 3316

Magnetic anisotropy phenomena in cold-rolled nickel-iron. RATHENAU, G. W., AND SNOEK, J. L. *Physica*, *'s Grav.*, **8**, 555–75 (*June*, 1941).—Annealed cold-rolled NiFe develops a very good [001]–(100) texture with [001] in the rolling direction (r.d.). If again rolled with r.d. [010] or [001] it becomes strongly anisotropic, with the direction of easy magnetization $\perp$ to the r.d. (transverse anisotropy). The crystal orientation is not affected, and the effect is much larger than the crystallographic anisotropy. It is not explained by internal stresses or a tetragonal distortion. It occurs for all compositions in the F.C.C. range, being greatest for the exact composition NiFe, and becoming zero for pure Ni. If the annealed sheet is stretched a few % (instead of being rolled) the direction of easy magnetization is $\perp$ to the stretch, whatever the stretch direction. Annealing at 500°–600°C practically removes the anisotropy in both cases. The behaviour of single-crystal sheet is the same, but unoriented sheet develops anisotropy with the direction of easy magnetization $\parallel$ to the r.d. (longitudinal anisotropy). Measurements were made of the anisotropy constant due to rolling (coefficient of term in 2θ) and that due to crystal anisotropy (coefficient of term in 4θ) by timing the oscillations of discs suspended in a magnetic field. The magnetostriction was also measured; it and the crystal anisotropy were little affected by rolling. Graphs of the measurements are given. A. J. C. W.

539.26 : 539.4.016.2 : 548.53 3317

Recrystallization in rolled nickel-iron. CUSTERS, J. F. H., AND RATHENAU, G. W. *Physica*, *'s Grav.*, **8**, 759–70 (*July*, 1941).—Most of the crystals present in cold-rolled Al, Cu and NiFe have either $(1\bar{1}0)$ in the rolling plane (r.p.) and [112] in the rolling direction (r.d.), or $(11\bar{2})$ in the r.p. and [111] in the r.d. Al recrystallizes in the rolling texture, but Cu and NiFe with (100) in the r.p. and [001] in the r.d. This so-called cube orientation is attributed to the rapid growth of a comparatively few grains with this orientation present in rolled Cu and NiFe, but undetectable in rolled Al. [See however Abstr. 3318, 3322 (1947)]. A small percentage of P prevents the formation of the cube orientation. Its effect seems to be on the process of recrystallization, since "germs" of the right orientation are still present in the rolled sheet. If the recrystallization temp. is < 1 000°C the cube orientation contains twins. Sufficiently thin sheets of Cu or NiFe recrystallize in the rolling texture; this can be explained on the assumption that slag inclusions, etc., set an upper limit to the region affected by a single germ. A. J. C. W.

539.26 : 539.4.016.2 : 548.53 = 3 3318

On the (111) reflection in rolled and recrystallized nickel-iron. CUSTERS, J. F. H. *Physica*, *'s Grav.*, **8**, 771–88 (*July*, 1941) *In German.*—The structure of cold-rolled NiFe, unannealed and annealed at 750° and 1 100°C, was investigated by transmission X-ray photographs. Pole figures for the (100) and (111) planes are given, for some treatments separately for the surface and the central layer of the sheet. Beside crystals in the cube orientation and in the rolling orientation [Abstr. 3317 (1947)] twins having a (111) plane in common with the cube orientation and so-called Z (= zwischen) crystals with an orientation $\sim 8°$ different from that of the twins are found. Very thin sheets ($\sim 0{\cdot}0005$ cm) contain a large fraction of Z crystals. In ordinary sheet the Z crystals disappear on annealing above 900°, but the twins persist at least to 1 100°C. It is suggested that the Z crystals reveal the ideal rolling texture. It cannot be expressed by any simple indices; the rolling plane is approximately $(79\bar{4})$ and the rolling direction $[\bar{5}47]$. A. J. C. W.

6 : 539.4.016.2 : 548.53 3319

ms of grain boundaries as may appear on primary stallization of deformed metals. SANDEE, J. *ca, 's Grav.*, **9**, 741–54 (*July*, 1942).—The shapes of boundaries are calculated on the assumptions that crystallite has a constant speed of growth, equal in directions, but that in general crystallites have ent speeds and start growing at different times. calculated shapes are in good agreement both with ved boundaries in recrystallized Al and with daries between colonies of moulds on agar. The ent occurrence of a certain sharply-pointed dary suggests that the approach of a recrystallized dary can stimulate a previously dormant crystallite. stimulated crystals are frequently spinel twins of timulant. A. J. C. W.

6 : 539.4.016.2 : 548.53 3320

hematic representation of nuclear growth in deformed ls. BURGERS, W. G. *Physica, 's Grav.*, **9**, 987–95 ., 1942).—The nuclei from which the recrystallization s in stretched Al plates may be regions where the rmation energy is low, the rate of growth being an easing function of the energy gradient. With tional assumptions the production of stimulation tals [Abstr. 3319 (1947)] can be explained. A. J. C. W.

26 : 539.4.016.2 : 548.53 3321

onounced secondary recrystallization of drawn inium. BURGERS, W. G., AND SANDEE, J. *Physica, Grav.*, **9**, 996–1002 (*Dec.*, 1942).—Drawn Al wire ystallizes first with the drawing orientation ([111] g the axis), but further heating (30 minutes at 630°c) luces large secondary crystals with [210] along the . It is suggested [see Abstr. 3320 (1947)] that the wn wire contains numerous regions of low deforma- energy and high energy gradient with the [111] ntation, and a few regions of still lower energy and energy gradient with the [210] orientation.

A. J. C. W.

26 : 539.4.016.2 : 548.53 3322

n the relation between deformation and recrystalliza- texture of nickel-iron with cubic orientation. CUSTERS, . H. *Physica, 's Grav.*, **13**, 97–116 (*March*, 1947).— d-rolled NiFe and Al have similar rolling textures str. 3317 (1947)], but NiFe has in addition some ns with the approximate orientation [100]–(011) and naller number with an orientation not simply de- bable. Pole figures are given. The difference in the ystallization textures of Al and NiFe is considered e due to growth in the latter of slip-fragments from grains in the additional orientations [see Abstr. 3318 47)]. Theories of recrystallization are discussed.

A. J. C. W.

.27 3323

letermination of the crystal structure of gold leaf by tron diffraction. RYMER, T. B., AND BUTLER, C. C. *c. Phys. Soc., Lond.*, **59**, 541–54 (*July*, 1947).—It is nd that the radii of the rings of Debye–Scherrer tron-diffraction photographs obtained from gold leaf not in exact agreement with the theoretical values. This is ascribed to the crystal lattice being distorted by surface-tension forces. A.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.31 3324

Theory of the increase in rigidity of rubber during cure. JAMES, H. M., AND GUTH, E. *J. Chem. Phys.*, **15**, 669–83 (*Sept.*, 1947).

539.312 : 538.65 = 4 3325

Internal friction in ferromagnetic metals and alloys. BOULANGER, C. *C.R. Acad. Sci., Paris*, **224**, 1286–8 (*May 5*, 1947) *In French.*—The internal damping of ferromagnetic metals and alloys varies greatly with the amplitude of oscillation, and is also influenced by an applied magnetic field. For pure Ni a field of 100 oersteds reduces the damping in the ratio 100 : 1. A. E. D. B.

539.32 : 548.0 : 534.321.9 3326

Ultrasonic measurements on single crystals. HUNTINGTON, H. B. *Phys. Rev.*, **72**, 321–31 (*Aug.* 15, 1947).—A pulse technique at 10 Mc/s has been used to measure acoustic velocity and attenuation of several alkali halides and Rochelle salt. Values for the elastic moduli of LiF, NaCl, KBr, and KI have been determined. The attenuation of the ultrasonic beam in these media is small. Corresponding measurements on the elastic moduli of Rochelle salt are reported. Under the assumption of plane wave transmission many of these moduli automatically correspond to those measured on foiled crystals by other methods. Attenuation is considerable in Rochelle salt, and appears to be excessively high for transmission involving the temperature-dependent c_{44} (foiled case). Where this modulus is involved marked effects have been observed from electric bias and mechanical pressure. A complete set of elastic moduli has been obtained and used to calculate the corresponding values for the moduli of compliance. A.

539.374 : 548.73 : 548.0 *see Abstr.* 3351

539.4.016 : 666.1.037.5 *see Abstr.* 3394

539.4.016.2 : 538.221 : 539.26 *see Abstr.* 3316

539.4.016.2 : 548.53 : 539.26 *see Abstr.* 3317–22

539.501 : 534.13 3327

The straining of constructions consisting of elastico-viscous elements. RZHANIZYN, A. R. *C.R. Acad. Sci. URSS*, **52** (*No.* 1) 25–8 (1946).—A material is said to be elastico-viscous when the relation between the strain, ε, and the stress, σ, is expressed by $nH\dot{\varepsilon} + E\varepsilon = \sigma + n\dot{\sigma}$, where H is the instantaneous modulus of elasticity, E the final modulus, and n the relaxation time. Most building materials (e.g. wood, concrete) satisfy this relation. The problem of an elastico-viscous rod losing stability under compression is studied. Formulae for the max. deflection are obtained when the compressive force $<$ its critical value. The equations of vibration of an elastico-viscous body are given and a formula for the amplitude of forced vibrations is obtained. L. S. G.

539.893 : 550.41 = 4 *see Abstr.* 3378

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

.123 : 536.71 = 4 *see Abstr.* 3195–6

.123.2 : 536.423.1 3328

/apor-liquid equilibrium diagrams of alcohol-ketone otropes as a function of pressure. BRITTON, E. C., NUTTING, H. S., AND HORSLEY, L. H. *Industr. Engng Chem.* (*Analyt. Edit.*) **19**, 601–2 (*Aug.*, 1947).

541.123.2 : 536.423.1 3329

Graphical method for predicting azeotropism and effect of pressure on azeotropic constants. HORSLEY, L. H.

Industr. Engng Chem. (*Analyt. Edit.*) **19**, 603–8 (*Aug.*, 1947).—Plots of Lecat's equations giving azeotrope boiling points in terms of those of the components are given for 45 systems. The method of using the graphs to determine the effect of pressure is described. [See Abstr. 1934 (1930)].

541.123.2 : 536.423.1 3330

Graphical method for predicting effect of pressure on azeotropic systems. NUTTING, H. S., AND HORSLEY, L. H. *Industr. Engng Chem.* (*Analyt. Edit.*) **19**, 602 (*Aug.*, 1947).—The vapour pressure curves of azeotropes are straight lines when log (vapour pressure) is plotted against $1/(t°C + 230)$. The method of constructing the curves from those of the components is described.

541.123.2/.3 : 536.423.1 3331

Table of azeotropes and nonazeotropes. HORSLEY, L. H. *Industr. Engng Chem.* (*Analyt. Edit.*) **19**, 508–600 (*Aug.*, 1947).—The boiling points and composition of 6 151 binary and 308 ternary mixtures are given, also the boiling points of the individual components. A formula index is provided, and 172 references listed.

541.123.59 : 539.155.2 = 4 3332

A technique for the study of isotopic exchange reactions. HAÏSSINSKY, M., AND PULLMAN, B. *J. Phys. Radium* (*Sér.* 8) **8**, 33–5 (*Feb.*, 1947) *In French.*—The rate of exchange in an isotopic exchange reaction has been evaluated by the comparison of the activities of two layers of equal thickness, composed of the substances which have taken part in the reaction. The present study deals with the general principles for the evaluation of the rate of exchange, the variation of β-activity as a function of the superficial mass of the active body, and details of the method of thick layers employed. The rate of exchange is obtained without a knowledge of the absolute quantities present. H. H. HO.

541.123,59 : 539.155.2 = 4 3333

Isotopic exchange in the systems MnO_2/Mn^{++} and PbO_2/Pb^{++}. PULLMAN, B., AND HAÏSSINSKY, M. *J. Phys. Radium* (*Sér.* 8) **8**, 36–8 (*Jan.*, 1947) *In French.*—The isotopic exchange in the systems shows that the rate of exchange varies appreciably according to the mode of preparation of the peroxide. The exchange reactions thus provide a diagnostic method for discrimination between quasi-identical compounds obtained by different methods, which present certain differences in their chemical and physical state. The influence of time and temperature on the rate of exchange is examined. Data is provided for MnO_2 prepared by three and PbO_2 by two different methods. The exchange is produced rapidly in the surface layers, and is then dependent on the speed of diffusion into the interior of the solid. H. H. HO.

ELECTROCHEMISTRY 541.13

541.132 = 4 3334

Electrolysis by successive current passage through gaseous and liquid phases. A new type of electrolysis in a neutral medium (distilled water). PAVLOV, V. I. *C.R. Acad. Sci. URSS*, **55** (*No.* 1) 37–40 (1947) *In French.*—Ions are forced into liquids by current passage from gas to solvent. Examples are given with full details of the processes of reduction of the cations of salts by gaseous anions (e.g. O_2^- and O^-), for solutions of Ag nitrate, Cu chloride, sulphate, and nitrate, of Pb acetate, and of Au chloride. Suggested technical applications are included. H. H. HO.

541.133 : 621.315.614.7 : 621.3.011.2 3335

The conduction of electricity through cellulose. I–III. O'SULLIVAN, J. B. *J. Text. Inst. Manchr*, **38**, T271–30 (*July*, 1947).—The paper consists of four parts dealin respectively with: (1) conductance of cellulose shee impregnated with salts, (2) chemical effects of the current (3) mobility of hydrogen and hydroxyl ions in cellulo sheet, and (4) mobility of various ions in cellulose sheet The experiments were carried out on cellulose shee ("Cellophane") samples impregnated by steeping various solutions. The conductivity at a given humidit increased with increasing salt content and depende somewhat on the actual salt present. For a given sal content, the conductivity is an exponential function o the conditioning humidity over a wide range. Lo (conductivity) is a non-linear function of the moistur content; the function is the same for all the samples, wit certain exceptions, which, however, can be brought int agreement also, by a transformation. The salt conter only affects the conductivity if <1%. Chemical effect take place which are, in general, of the same kind a occur during the electrolysis of an aqueous solutio It is concluded that the conduction is essentially ioni For the mobility measurements the material was in pregnated with an alkali salt and a mixture of indicator Velocities of migration were calculated from the rate movement of the coloured boundaries. The mobiliti of both H and OH ions in cellulose sheet were found be dependent on the moisture content of the sample, th relationship being approx. the same as that betwee moisture content and conductivity. The behaviour K, Ca, Fe, Cu, Ag, Cl, SO_4 and CrO_4 ions was simila to that for H and OH. Fair agreement was obtaine between the calculation of the conductivity of KCl ar $CuSO_4$ impregnated sheets, on the assumption that th conduction was entirely ionic, with the measured co ductivities of the materials. A. M.

COLLOIDS . DISPERSE SYSTEMS 541.18/.1

541.182 33

Spatial arrangement and interactive energies of sm particles. VAN KREVELD, A. *Physica*, *'s Grav.*, 1 265–78 (*May*, 1947).—The random distributions of sm particles, as revealed, for instance, by microscop counting of colloids, are considered in connection wi the interactive energies. The counting fluctuations a calculated from the "distribution-functions" (on t analogy of Zernike and Prins's molecular distributio functions [Abstr. 1773 (1927)] and vice versa. T interactive potential functions of the particles are co puted from the distribution-functions and so fro experimental counting results. The calculations apply homogeneous systems as well as to mixtures of differe particles.

541.182.6 : 537.228.3 : 535.515 = 4 *see Abstr.* 3158

ADSORPTION 541.183

541.183.3 : 532.13 = 4 33

A theory of the viscosity of monomolecular lay based on their structure. I–II. JOLY, M. *J. Ph Radium* (*Sér.* 8) **7**, 83–93 (*March*); 112–21 (*April*, 19 *In French.*—Part I gives a simple theory based on work of Eyring to explain the viscosity of monomolecu films spread on aqueous solutions. This results from consideration of the activation energy as a function van der Waals' forces and a few simple hypothe regarding the structure of the films and the equilibri states of the molecules. The theoretical treatment extended in Part II, where the effect of the H_2O molecu

substrate is considered, leading, for cases of liquid gaseous films, to an explanation of the observed ise of viscosity with increase of molecular area. heory is applied to experimental results obtained ms of palmitic acid, oleic acid and tricaproin. J. I.

83.56 3338

asurements of the adsorption of hydrogen on glass. DM, W. H., AND SCHWEERS, J. *Commun. K. Onnes Leiden* (*No.* 264*b*). *Physica*, *'s Grav.*, **8**, 1007–20 , 1941).—The glass was a long narrow tube in spiral For temps. over the range 20·3° to 14·2°K and ures p up to 9 000 bars the isotherms followed the ion $\log X/p = aX + B$ (X = adsorption, A and B near functions of T^{-1}): adsorption was reversible. eat of adsorption ΔH was a linear function of X; im probably exceeded a monolayer at the higher ures. S. J. G.

83.56 3339

ne measurements on the adsorption of neon and of n on glass. KEESOM, W. H., AND SCHWEERS, J. *nun. K. Onnes Lab. Leiden* (*No.* 264*c*). *Physica*, *'s* ., **8**, 1020–31 (*Dec.*, 1941).—See Abstr. 3338 (1947). adsorption isotherms, determined at temps. ranging 20° to 11° for Ne and from 9° to 1°K for He, and ures up to 2×10^4 bars, did not fit any simple tions. ΔH fell considerably as X increased. rption of Ne probably exceeded a monolayer near aturated vapour pressure. S. J. G.

83.56 3340

easurements on the adsorption of helium on solidified s of some gases. KEESOM, W. H., AND SCHWEERS, J. *nun. K. Onnes Lab. Leiden* (*No.* 264*d*). *Physica*, *'s* ., **8**, 1032–43 (*Dec.*, 1941).—See Abstr. 3338–9 (1947). rption isotherms of He on glass carrying adsorbed of H_2, Ne, N_2 and O_2 were measured at temps. 4° K and pressures up to 10^4 bars. On H_2 the adsorp- was ~3%, on Ne ~ 30%, and on N_2 and O_2 ~ 100% on glass. With increasing p, the film probably eded a monolayer with Ne, N_2 and O_2. S. J. G.

183.56 : 533.5 3341

ne sorption of gases by barium. DE GRAAF, J. E., AND AKER, H. C. *Physica*, *'s Grav.*, **9**, 297–9 (*March*,).—It is shown that barium has a much higher ring power if it is evaporated quickly in not too good cuum, giving a black deposit rather than a mirror. experiments support the hypothesis that the effect ue to the much greater surface area of the finely ded Ba in a black deposit. In a CO_2 atmosphere the pressure for the deposition is 0·4 mm Hg. A. H. W. B.

183.56.08 3342

new method for measuring adsorption of gases and urs by solids. BERING, B. P., AND SERPINSKY, V. V. . *Acad. Sci. URSS*, **55** (*No.* 8) 731–4 (1947).—The ge in weight of the *adsorbate* is measured: a McBain tion balance carries a bucket with w g of an auxil- absorbent, and can be connected to the dead space the main adsorbent (50 g). The sensitivity of surements of adsorption per g of main adsorbent is increased by $\sim\times 50/w$. S. J. G.

183.56.08 : 537.311.4 3343

dsorption phenomena on massive metal surfaces sured by means of electrical contact resistances. ST, J. J. *Physica*, *'s Grav.*, **8**, 233–50 (*Feb.*, 1941).— rods of the metal are pressed together in an enclosed el by a known weight, and the "transition resistance" t the point of contact is measured. From R the kness of the layer of gas adsorbed on the metal can alculated. O_2 molecules adsorbed on Mo at −160° lie flat, and may build up to a second layer. Activated adsorption and migration of O_2 occurs at room temp. S. J. G.

CHEMICAL STRUCTURE 541.4/.6

541.57 : 539.132 *see Abstr.* 3274

541.57 : 539.133 = 4 *see Abstr.* 3277

541.67 : 538.214 *see Abstr.* 3248

CHEMICAL PROCESSES 542.9

542.9 : 537.561 : 538.691 3344

The study of reaction intermediates by means of a mass spectrometer. I. Apparatus and method. ELTENTON, G. C. *J. Chem. Phys.*, **15**, 455–65 (*July*, 1947).—A method for coupling a reaction chamber to a Dempster-type mass spectrometer in such a manner that short-lived intermediates can reach the electron beam is described. The presence of radicals is denoted by an increase in the ion current of the corresponding mass. The sensitivity of the method depends on the difference between the appearance potential of the given ion produced by electron bombardment of either reactants or end products and the ionization potential of the free radical. It is shown experimentally that excited molecules are not present in sufficient quantity to invalidate the assumption that free radicals are responsible for the changes in ion current. The method has already extended more than tenfold the pressure range in which radicals are detectable, thus bridging the gap between mirror and spectroscopic methods so that low pressure combustion phenomena may be studied. **II.** (*Ibid.*, 465–73). **The thermal decomposition of some lower hydrocarbons. III.** (*Ibid.*, 473–81). **Low pressure flames.** A.

CHEMICAL ANALYSIS 543/545

545.37 = 4 3345

A new method for polarographic measurements with applications. REBOUL, G., AND BON, F. *C.R. Acad. Sci., Paris*, **224**, 1263–4 (*May 5*, 1947) *In French.*—In order to increase the ease and sensitivity of polarographic measurements, the usual procedure is replaced by one based on variations, as a function of time, of the intensity of the instantaneous current produced during the formation of the Hg drop. In this way, the total value of a surface limited by a curve is changed to one of detailed knowledge of the curve itself. Experimental details are briefly included with applications. The method enables the state of purity of Hg to be determined. H. H. HO.

545.7 : 536.23 3346

Use of convection effects in gas analysis by thermal conductivity. MINTER, C. C. *Industr. Engng Chem.* (*Analyt. Edit.*) **19**, 464–5 (*July*, 1947).—A method has been developed for analysing a ternary mixture of gases by comparing its thermal conductivity with that of a binary mixture of known composition, and then comparing the effect of pressure on convection for the two mixtures. While the ternary mixtures investigated consisted only of H, CO_2, and CH_4, the method should be applicable to other combinations of gases that do not react chemically with each other. A.

545.8 : 539.16.08 = 4 *see Abstr.* 3292

545.8 : 539.165 *see Abstr.* 3302

545.82 3347

The spectrographic analysis of ferro-silicon. COULLIETTE, J. H. *J. Opt. Soc. Amer.*, **37**, 609–13 (*Aug.*, 1947).—A method has been devised for the spectro-

graphic analysis of materials consisting of two or more principal components. One of the components is selected as a reference element. The ratios of the concentrations of the various component elements to the concentrations of the reference element in a set of standard samples are computed. These ratios are plotted against spectral line intensity ratios to form the working curves. Having determined the intensity ratios for an unknown sample, its composition is readily computed from a set of simple equations. Complete details of the application of the method to the analysis of ferro-silicon are given. Use of this method eliminates the necessity for adding a standardizing material to the sample or making approximations to correct for reference element dilution. A.

545.82 33

The effect of alkali and alkaline earth salts on t spectrographic determination of strontium. FAST, E., A NIELSEN, J. R. *J. Opt. Soc. Amer.*, **37**, 614–22 (*Aug* 1947).

545.82 : 535.33 33

Continental wartime developments in spectroscop technique. VAN SOMEREN, E. H. S. *J. Sci. Instrum.*, 2 225–30 (*Sept.*, 1947).—A short review of published pape is given, with 59 references grouped as follows: review apparatus; light sources; technique; methods; scop They mainly deal with spectrochemical analysis.

545.824 : 531.717 : 535.34 : 537.531 = 4 *see Abstr.* 3215

545.828 : 535.371 = 3 *see Abstr.* 3144

CRYSTALLOGRAPHY 548

548.0 : 534.321.9 : 539.32 *see Abstr.* 3326

548.0 : 536.631 = 4 *see Abstr.* 3194

548.0 : 537.311.1 : 539.1 *see Abstr.* 3268

548.0 : 538.222 *see Abstr.* 3256–7

548.0 : 538.614 : 538.222 *see Abstr.* 3255

548.0 : 539.133 3350

Magnetic dipole fields in unstrained cubic crystals. MCKEEHAN, L. W. *Phys. Rev.*, **72**, 78 (*July* 1, 1947).—This note corrects some numerical values in an earlier paper [Abstr. 3810 (1933)]. W. E. D.

548.0 : 539.23 = 3 *see Abstr.* 3314

548.0 : 539.374 : 548.73 3351

Low temperature transformation in lithium. BARRETT, C. S. *Phys. Rev.*, **72**, 245 (*Aug.* 1, 1947).—A face-centred cubic structure can be produced in Li in the region of −196°c if the metal is plastically deformed. X-ray analysis gives the lattice const. as 4·41 Å; for the cubic phase at this temp. it is 3·50 Å. The transformation can be heard taking place by the emission of small audible clicks. This phase disappears when heated above −117°c. [See Abstr. 2692 (1947)]. W. E. D.

548.24 3352

Artificial electric twinning in quartz crystals. VORMER, J. J. *Proc. Inst. Radio Engrs, N.Y. Wav. Electrons*, **35**, 789–90 (*Aug.*, 1947).—By local heating to <573°c, localized twinning is easily produced in AT- CT-, and GT-cut quartz plates. This twinning is of the electrical or Dauphine type. It may result from manufacturing operations, but may be prevented. A.

548.5 : 535.551 *see Abstr.* 3161

548.53 : 539.4.016.2 : 539.26 *see Abstr.* 3317–22

548.7 3353

Order and disorder in arrangements of small numbers of atoms. FOKKER, A. D. *Physica, 's Grav.*, **8**, 109–32 (*Jan.*, 1941).—It is assumed that in a binary structure of composition AB the lattice sites can be divided into 2 groups of n each, each site of one set being completely surrounded by z of the other set. The *disorder parameter* u is the number of exchanges of A and B atoms required to produce complete order. The *long-range-order* parameter is $S = (n - 2u)/n$. The configurational energy depends to a first approx. on η, the number of pairs of adjacent like atoms. The *degree of local order* is $\sigma = 1 - 2\eta/nz$. The problem proposed is to find the number of configurations, out of the total $(2n)!/(n!)^2$, for a given η. For a given u it is $(n!)^2/(u!)^2[(n-u)!]^2$. The number of configurations $W(u, \eta)$ is enumerated for various square and hexagonal arrangements for $n <\sim 12$, the sums $A(\eta) = \sum_u W(u, \eta)$ formed, and the energy a heat capacity evaluated as a function of T. A critic temp. for C_v does not necessarily imply one for S. A. J. C.

548.7 33

Order and disorder for small numbers of aton FOKKER, A. D. *Physica, 's Grav.*, **8**, 159–60 (*Feb.*, 194 —The analysis of Abstr. 3353 (1947) is extended to atoms of each kind in hexagonal array. A. J. C.

548.7 33

Errata: Theory of dipole interaction in crystals. L TINGER, J. M., AND TISZA, L. *Phys. Rev.*, **72**, 257 (*Aug.* 1947).—See Abstr. 1043 (1947).

548.7 : 539.11 33

Interatomic distances in crystals and the Hun Rothery formula. SARKISSOV, F. S. *C.R. Acad. S URSS*, **55** (*No.* 8) 727–30 (1947).—Use of an effect atomic number $Z_{eff} \equiv Z^{2/3}$ allows a simpler expression some atomic properties. Interatomic distances in ea row of the periodic table vary according to the form $d = CZ_{eff}^{a}$, where C is a constant depending on the peri and sub-group (A or B). The value of a is $-(2^{n-2} +$ where n is the principal quantum number of the out most electrons for the A sub-groups, and is n–2 for B sub-groups. A. J. C.

548.7 : 539.133 : 535.343.2–15 = 4 *see Abstr.* 3125

548.7 : 669.018 3

Order and disorder in compound lattices. FOKK A. D. *Physica, 's Grav.*, **8**, 308–20 (*Feb.*, 1941).— approximate theory is developed, with nearest-neighb interactions only, of the stability of order in bin alloys of face-centred cubic structure. At the compositi AB_3 a cubic superstructure is stable below a criti temp., at AB a tetragonally-distorted superstructu At A_2B_3 the cubic superstructure is stable betwee min. and a max. critical temp, and at A_9B_{11} there ranges of stability for both cubic and tetragonal sup structures. Below the min. temp. of stability of superstructures the alloy would be two-phase. A. J. C.

548.713 : 532.623 : 539.21 3

A dynamical model of a crystal structure. BRAGG, AND NYE, J. F. *Proc. Roy. Soc. A*, **190**, 474–81 (*Sept.* 1947).—The crystal structure of a metal is represen by an assemblage of bubbles, 1 mm or less in diame floating on the surface of a soap solution. The bubb are blown from a fine pipette. They are held toget by surface tension, either in a single layer on the surf or in a 3-dimensional mass. An assemblage may cont hundreds of thousands of bubbles and persists for an h

nore. The assemblages show structures which have supposed to exist in metals, and simulate effects h have been observed, such as grain boundaries, cations and other types of fault, slip, recrystallization annealing, and strains due to "foreign" atoms. A.

73 : 535.42 : 537.531 *see Abstr.* 3217

73 : 539.374 : 548.0 *see Abstr.* 3351

735 : 518.5 3359

wo calculating machines for X-ray crystal structure ysis. BOOTH, A. D. *J. Appl. Phys.*, **18**, 664–6 , 1947).

735.44 3360

iffraction effects in Fourier syntheses and their ination in X-ray structure investigations. VAN EN, L. L. *Physica, 's Grav.*, **9**, 461–80 (*May*, 1942).— deviations of the electron cloud of an atom from rical symmetry are important for the understanding ne chemical bond, but may be masked by diffraction cts if the highest-order reflections are large. Diffrac- effects can be eliminated by an artificial temp. factor, ne expense of a general blurring of the pattern. In tals containing one type of atom only (e.g. diamond, ussed in some detail) it is more satisfactory to apolate the observed F *v.* $(\sin\theta)/\lambda$ curve and include higher terms of the series. Except near the centre of atom the empirical formula used for extrapolation f little influence. A. J. C. W.

735.44 3361

he accuracy of atomic co-ordinates derived from rier series in X-ray structure analysis. III. BOOTH, D. *Proc. Roy. Soc. A*, **190**, 482–9 (*Sept.* 9, 1947).— Abstr. 1050 (1947). Further work has resulted in a e satisfactory treatment of finite summation errors in 3-dimensional diatomic case. The results are ex- ded to the 2- and 1-dimensional series, and the resting result emerges that finite summation errors of the same order of magnitude whatever the di- sions of summation. Using the new results a more ntitative examination of the effects of real thermal ion becomes possible. It is shown that the relative uracies of parameters in structures, the higher order ctions from which are suppressed by thermal motion, ows a simple power law in the corresponding reci- cal spacings. These considerations lead to an mination of the artificial temperature factor method securing convergence, and it is shown that this duces greater errors due to overlapping than those designed to eliminate. A method of correcting these ortions is suggested. Finally, the treatment of the ct of experimental errors is extended to 2 and 1 ensions, and it is shown that the 3-dimensional mation is least affected by experimental inaccuracy. errors for 3-, 2- and 1-dimensional summation, in a ticular case, are calculated to be in the ratio 1 : 3 : 10. A.

.735.44 : 548.737 3362

he accuracy of atomic co-ordinates derived from rier series in X-ray structure analysis. IV. The two- ensional projection of oxalic acid. BOOTH, A. D. c. *Roy. Soc. A*, **190**, 490–6 (*Sept.* 9, 1947).—The hods [Abstr. 3361 (1947)] have been applied to an mination of the errors in the atomic co-ordinates ived from the (h, 0, l) projection of oxalic acid ydrate. It is shown that the experimental errors are the order $\pm 0{\cdot}01$ Å, and that the finite summation ors are slightly larger—in agreement with the theo- cal predictions of the former papers. Recent work, ng more extensive experimental data, is discussed, and it is concluded that, owing to the introduction of an artificial temp. factor, the results are unlikely to be of greater accuracy than the originals. A.

548.735.46 3363

Patterson–Harker maps of molecular crystals. BOOTH, A. D., AND WRINCH, D. *J. Chem. Phys.*, **15**, 416–17 (*June*, 1947).—If a crystal contains only similar and similarly situated molecules whose distance of closest approach is k, there is a region about the origin of the Patterson, extending at least to a sphere of radius k, due only to the intramolecular structure. If the molecules are not similar this region contains simply the sum of the intramolecular Pattersons, with no intermolecular peaks. A. J. C. W.

548.736.339 3364

The crystal structure of anhydrous cupric bromide. HELMHOLTZ, L. *J. Amer. Chem. Soc.*, **69**, 886–9 (*April*, 1947).—The structure determined by X-ray diffraction consists of chains with composition $(CuBr_2)_n$ formed by the sharing of the edges of the squares of Br atoms surrounding the Cu atoms. Formation of fifth and sixth valency bonds from the Cu leads to the overall structure being monoclinic. The structure is compared with that of $PdCl_2$ and Cu complex ions. W. R. A.

548.736.34 3365

The crystal structure of strontium azide. LLEWELLYN, F. J., AND WHITMORE, F. E. *J. Chem. Soc.*, 881–4 (*June*, 1947).—The structure was completely determined by means of 3-dimensional Fourier sections and lines using all the $\{hkl\}$ structure amplitudes obtainable with Cu $K\alpha$ X-radiation. The structure is ionic, each Sr ion being surrounded by 8 azide ions, arranged in two sets, at distances 2·63 and 2·77 Å, severally. The azide ion is linear and symmetrical, the N–N separation being 1·12 Å. A.

548.736.442 3366

The crystal structure of sodium iodate. NÁRAY-SZABÓ, I., AND NEUGEBAUER, J. *J. Amer. Chem. Soc.*, **69**, 1280–3 (*June*, 1947).—Sodium iodate has an orthorhombic lattice with space group V_h^{16}—*Pbnm*. Oscillation diagrams about crystallographic axes gave edges of unit cell, $a = 5{\cdot}75$, $b = 6{\cdot}37$, $c = 8{\cdot}10$ Å. There are four formula weights of $NaIo_3$ in the cell. The crystal contains distinct Io_3 radicals. Parameter values are given. W. R. A.

548.736.452 3367

Crystal structure of sodium borohydride. SOLDATE, A. M. *J. Amer. Chem. Soc.*, **69**, 987–8 (*May*, 1947).—The structure, as determined by X-ray analysis, is based on a face-centred cubic lattice, probably made up of tetrahedral BH_4' ions and Na^+ ions; rotation of the BH_4' tetrahedra is expected. W. R. A.

548.737 3368

Cell dimensions and space group of regular acid sodium acetate: $CH_3COONa \cdot CH_3COOH$. LEBRET, M. C. *Rec. Trav. Chim. Pays-Bas*, **66**, 199–200 (*March–April*, 1947).—A rotation diagram and several Sauter diagrams were made around the [001] axis. Period = 15·86 ± 0·01 Å. Measured density: 1·39. Number of molecules per cell: 24. Space group: $T_h^7 - I\,a\,3$. A.

548.737 3369

The crystal structure of *p*-dinitrobenzene. LLEWELLYN, F. J. *J. Chem. Soc.*, 884–90 (*June*, 1947).—The crystal structure of *p*-dinitrobenzene was completely determined by utilizing all the diffracted beams obtainable with Cu $K\alpha$ X-radiation. The molecule is centrosymmetrical, and the C atoms of the benzene nucleus are located on a

regular hexagon such that the C–C distance is $1{\cdot}38_5$ Å. The nitro-group is planar, and coplanar with the rest of the molecule; its dimensions are C–N = 1·41, N–O = 1·23 Å A.

548.737 3370

The crystal structure of some molecular complexes of 4 : 4′-dinitrodiphenyl. II. The complexes with benzidine, *NN* : *N′N′*-tetramethyl-benzidine, 4 : 4′-dihydroxydiphenyl, 4-iododiphenyl and 4-bromodiphenyl. SAUNDER, D. H. *Proc. Roy. Soc. A*, **190**, 508–17 (*Sept.* 9, 1947).

548.737 3371

Some apparent periodic errors in the crystal lattice of the molecular complexes of 4 : 4′-dinitrodiphenyl with 4-iodo- and 4-bromodiphenyl. JAMES, R. W., AND SAUNDER, D. H. *Proc. Roy. Soc. A*, **190**, 518–33 (*Sept.* 9, 1947).—Oscillation photographs show a mixture of sharp and diffuse spots. When the oscillation is about the *c*-axis the spots on every 7th layer-line are observed to be sharp, those on all the other lines being diffuse. The spacing of the diffuse layer-lines in the bromo-complex is anomalous, and the positions of the lines correspond to those of optical ghosts accompanying the sharp layer-lines, such as would be expected if a fundamental spacing of 3·69 Å were periodically distorted with a period of rather $< 3\frac{1}{2}\times$ that of the fundamental spacing. The diffuseness suggests also faults in the *b*-direction. A suggested explanation of the effects in terms of the structure is put forward. A mathematical discussion of diffraction by a simplified model, consisting of a lattice with a periodic error in spacing in the *c*-direction, and faults consisting of sudden random changes in the phase of a periodic error in lattice planes perpendicular to the b^*-axis, is discussed, and it is shown that the diffraction pattern given by such a structure exhibits features similar to those observed. A.

548.737 3372

An X-ray study of horse methaemoglobin. I. BOYES-WATSON, J., DAVIDSON, E., AND PERUTZ, M. F. *Proc. Roy. Soc. A*, **191**, 83–129 (*Sept.* 26, 1947).—A fuller report, with some modification in the conclusions, of work described in Abstr. 2535 (1939), 1830 (1942), 22[illegible] (1943). Horse methaemoglobin is monoclinic, spa[illegible] group *C*2, with two molecules of weight 66 700 ± 3 5[illegible] per unit cell. In the normal state about ½ the volume [illegible] the crystal is occupied by liquid of crystallization; th[illegible] amount and composition of the liquid can be varie[illegible] deliberately. The changes in the unit cell are di[illegible] continuous and reversible. From these changes ar[illegible] those in the intensities of the X-ray reflections inform[illegible] tion can be obtained about the phases of the structu[illegible] amplitudes. Three partly independent methods a[illegible] available: (*a*) loading the liquid of crystallization wi[illegible] heavy ions, a procedure analogous to the well-knov[illegible] method of isomorphous replacement, (*b*) varying th[illegible] amount of the liquid, so that the X-ray reflections tra[illegible] out the molecular Fourier transform, and (*c*) study [illegible] one-dimensional Patterson syntheses at various stages [illegible] shrinkage. By a combination of these methods the sig[illegible] of the 001's were determined, and one-dimension[illegible] Fourier syntheses made. From the syntheses ar[illegible] considerations of packing it is concluded that haem[illegible] globin molecules are roughly cylindrical with height 34[illegible] and diameter 57 Å. Each cylinder appears to ha[illegible] concentrations of scattering matter arranged in layers [illegible] to the axis and about 9 Å apart. The indications giv[illegible] by X-ray analysis as to the chemical nature of the mo[illegible] cule and the liquid of crystallization are discuss[illegible] briefly. A. J. C. [illegible]

548.737 : 548.735.44 *see Abstr.* 3362

548.74 33[illegible]

Diffraction of electrons by selenium. CUSTERS, J. F. [illegible] *Physica, 's Grav.*, **9**, 385–94 (*April*, 1942).—Electr[illegible] diffraction photographs taken by reflection from [illegible] smooth Se surface, prepared from the molten metal [illegible] pouring it on freshly-cleaved mica and stripping, sh[illegible] that the (100) planes are parallel to the surface. This [illegible] confirmed by X-ray diffraction examination. A d[illegible] placement of spots on the electron diffraction phot[illegible] graphs is put down to refraction arising from the ex[illegible] tence of an internal potential of ~+12 V. J. [illegible]

GEOPHYSICS 55

550.34 3374

Seismic waves in western and central Europe. JEFFREYS, H. *Mon. Not. R. Astr. Soc., Geophys. Suppl.*, **5** (*No.* 5) 105–19 (1947).—Examination of 6 near earthquakes suggests that the travel-time of *P* in this region is less by 0·5 sec per 1° than in S. Europe and Japan. This is consistent with results from the Burton-on-Trent explosion [Abstr. 3375 (1947)] if the foci were shallow, probably within the sedimentary layer. Certain discrepancies in the observations remain unexplained. A. HU.

550.341 : 534.213 *see Abstr.* 3095

550.342 3375

On the Burton-on-Trent explosion of 1944 November 27. JEFFREYS, H. *Mon. Not. R. Astr. Soc., Geophys. Suppl.*, **5** (*No.* 5) 100–4 (1947).—Seismograms of this explosion from 4 British and 6 European stations are examined. The times of *Pn* at a distance of 8° are 3·9 sec < those given in the B.A. tables. The anomaly cannot be explained by reducing the upper-layer thicknesses, but it may be due to an increase in the velocity of *Pn* at short distances [Abstr. 3374 (1947)]. *Sg* was satisfactorily recorded, so that *Sg* was probably correctly identified in the Oppau explosion in spite of its low velocity. About 3×10^{-4} of the total energy was communicated to t[illegible] ground. A. H[illegible]

550.361 33[illegible]

The time necessary for a bore-hole to attain temperatu[illegible] equilibrium. BULLARD, E. C. *Mon. Not. R. Astr. So[illegible] Geophys. Suppl.*, **5** (*No.* 5) 127–30 (1947).—Heat generat[illegible] by the drilling tool and by circulation of the drilling flu[illegible] will affect estimates of the geothermal gradient unl[illegible] time is allowed for the disturbance to subside. [illegible] simplified calculation shows that the disturbance [illegible] negligible within 5 m of the hole. In a typical case t[illegible] hole must be left for 10 to 20 times the drilling time [illegible] get within 1% of equilibrium, though at the botto[illegible] equilibrium may be reached in a few days. A. H[illegible]

550.385 : 523.774 *see Abstr.* 3020

550.41 = 4 33[illegible]

States of matter in petrogenesis at great dep[illegible] GLANGEAUD, L. *Experientia*, 3 (*No.* 1) 1–11; (*No.* [illegible] 58–9 (1947) *In French.*—Mérigoux's principle of anam[illegible] matism [see Abstr. 3379 (1947) is applied to the ori[illegible] of rocks within the earth's crust. W. A. [illegible]

550.41 : 539.893 = 4 33[illegible]

Molecular interaction and anamigmatism. MÉRIGOU[illegible]

Experientia, **2** (*No.* 12) 488–90 (1946) *In French.*—h pressures are found to reverse conditions at rfaces and to promote diffusion. The phenomenon is ed *anamigmatism.* W. A. R.

837 : 621.396.945 = 3 3379

lectrical processes in applied geophysics. FRITSCH, V. *Ingen. Arch.*, **1** (*No.* 3) 190–203 (1946) *In German.*—hort account of the application of radio methods is uded. W. A. R.

46.018.4 : 531.787.2 = 5 3380

he thermobatigraph. TENANI, M. *Ric. Sci.*, **14,** -7 (*Oct.–Nov.–Dec.*, 1943) *In Italian.*—The instru-nt records submarine pressure by means of the pressi[illegible] f a brass tube with corrugated wall and, ultaneously, temperature by a bi-metallic strip wound piral. Detailed description, illustrations and samples ecords are given. J. A. W.

METEOROLOGY 551.5

.508.11 : 621.396.91 3381

The Kew radio sonde. DYMOND, E. G. *Proc. Phys. ., Lond.*, **59,** 645–66 (*July*, 1947).—This works on the nciple of a varying inductance changing the note of an oscillator, which modulates the radio transmitter. e design of airborne instrument, ground receiving paratus and calibrating plant is described. The bable errors are ~ ±5 mb and ±0°·4C for pressure temp. over the atmospheric range up to 22 km ght, and ±10% relative humidity down to temps. of 0°C, below which the hygrometer element becomes eliable or inoperative. The reliability is high, over % of the soundings being successful. A.

1.508.11 : 621.396.91.083.7 3382

Radiosonde telemetering system. HAUCK, V. D., SBY, J. R., AND DEMBER, A. B. *Electronics*, **19,** 120–3 *fay*, 1946).—Describes the AN/AMQ-1D equipment, ich consists of humidity- and temp.-sensitive elements, eroid switch, battery and electronic unit together with loon and parachute. A 3A5 double-triode provides, a 1 Mc/s oscillator with a variable relaxation fre-ency of 10 to 200 c/s and (*b*) a 72 Mc/s oscillator, odulated by the first half and feeding a dipole aerial. e aneroid pressure cell movement operates a contact itch allowing the humidity and temp. elements to ect the relaxation frequency in turn. The hygrometer it is a polystyrene strip coated with LiCl, while for np. measurement a ceramic resistor is used. H. G. M. S.

1.510.535 3383

Geomagnetic control of F_2 layer ionization. APPLETON, *Science*, **106,** 17 (*July* 4, 1947).—See Abstr. 1989 (1946). It is further pointed out that the conditions of F_2 layer bifurcation observed on the magnetic equator are also met with, e.g. at Slough (England) during the summer, i.e. when the sun is near zenith, with marked reduction of the ionization of the upper component. The variation with sunspot strength of moon ionization densities depends on the season, and it is suggested that a seasonal variation of the atmospheric medium is responsible.

551.521 : 628.92 = 393 3384

Daylight. REESINCK, J. J. M. *Electro-techniek*, **25,** 238–40 (*July* 31, 1947) *In Dutch.*—Spectrum, daily and annual variation of solar and sky radiation are discussed and results of some measurements are given, with special regard to the statistics of diffuse daylight for illumination purposes. J. A. W.

551.553.22 : 551.58 = 3 3385

New discoveries regarding meteorology and climatology of the Föhn. PROHASKA, F. *Experientia*, 3 (*No.* 6) 232–8 (1947) *In German.*—The theories of von Ficker and Frey regarding the "föhn" in the Swiss Alps have been examined further by use of new information. It is shown that the energy of the föhn due to depressions is caused by the pressure gradient and the baroclinic field. This in turn is caused by isobaric temp. differences between the Alpine mountains and the free atmosphere in their lee. The result is an air current with a downward component in the lee. At the beginning the descent of the föhn is due to the outflow of the cold air on the higher ground. Later the energy of the föhn increases so much that the cold air is swept from the valleys. The development of the föhn in an anticyclonic system is also explained. The two kinds of föhn are also discussed in regard to their climatological influences. R. S. R.

551.58 : 551.553.22 *see Abstr.* 3385

551.594.221 : 621.316.9 3386

A lightning warning device. SCHONLAND, B. F. J., AND GANE, P. G. *Trans. S. Afr. Inst. Elect. Engrs*, **38,** 119–25 (*April*, 1947).—It is briefly shown how field changes due to lightning flashes occurring within a given area can be transformed into current pulses by means of an aerial system, and how the point discharge current produced by a vertical rod can be used to indicate the imminence of a close lightning flash. An electronic device is described in which these phenomena are utilized to produce an audible and visible warning of an approaching thunderstorm or of an imminent flash. The particular equipment described indicates average flashes up to distances of 20 miles; it is designed as a warning device for explosives factories, which are shown to have suffered, in preceding years, considerable damage, including loss of life. R. H. G.

BIOLOGY 57/59

6.8.095.2 : 531.733 *see Abstr.* 3070

3.112.3 : 532.59 *see Abstr.* 3079

EDICAL SCIENCE . HUMAN PHYSIOLOGY 61

2.843.31 3387

The recognition of coloured light signals which are near e limit of visibility. HILL, N. E. G. *Proc. Phys. Soc., ond.*, **59,** 560–73 (*July*, 1947).—Statistical tests on the cognition of colour were made to find the range of lours which would be best for aviation signals. wenty-three colours were seen as point sources by 9 bservers of normal colour vision for eye illuminations 1 mile-candle and 2 mile-candles. The results indicate at yellow + orange is the least satisfactory colour group for signals of low illumination. A modification is suggested to the specification for "aviation white" to avoid the risk of confusion with yellow + orange. A.

612.843.31 3388

The measurement of the chromatic and achromatic thresholds of coloured point sources against a white background. HILL, N. E. G. *Proc. Phys. Soc., Lond.*, **59,** 574–85 (*July*, 1947).—Measurements were made to determine the effect of background brightness on the recognition of aviation light signals. White, yellow, red, and green point-source signals were observed by monocular foveal vision against a white background whose brightness was varied from 10^{-3} to 2·6 candles/ft^2. Curves were drawn for 50% recognition, and it is estimated that the thresholds for reasonable certainty of

recognition are from 3–5× those given. It is concluded that yellow is a comparatively unsatisfactory colour at both very low and very high background brightnesses. A.

612.843.32 3389

The sensitivity of the human eye to infra-red radiation. GRIFFIN, D. R., HUBBARD, R., AND WALD, G. *J. Opt. Soc. Amer.*, **37**, 546–54 (*July*, 1947).—The spectral sensitivity of human vision has been measured in the near infra-red, in two areas of the dark adapted eye: the central fovea (cones) to 1 000 mμ, and a peripheral area in which the responses are primarily caused by rods, to 1 050 mμ. The spectral sensitivity of the fovea determined in this way is consistent with previous measurements of Goodeve on the unfixated eye. At wavelengths >800 mμ the periphery becomes appreciably more sensitive than the fovea. Lengthening the exposure time increases the sensitivity of the periphery relative to the fovea. At 1 050 mμ the sensitivity of the periphery is only $3\times10^{-13}\times$ its max. value at 505 mμ. A computation shows that by 1 150 or 1 200 mμ radiation should be more readily felt as heat by the skin than seen as light by the eye. A.

612.843.6 3390

Size, shape, and contrast in detection of targets by daylight vision. I. Data and analytical description. LAMAR, E. S., HECHT, S., SHLAER, S., AND HENDLEY, C. D. *J. Opt. Soc. Amer.*, **37**, 531–45 (*July*, 1947).—The influence of size and symmetry has been studied on the contrast required for the recognition of rectangular targets against background brightnesses of 2 950 and 17·5 footlamberts. Targets $<2'$ dia. require the addition of a constant total light flux to the background. Larger targets require less contrast but more total flux as the area increases, until $>200'^2$ when the required contrast becomes independent of area. For areas $<100'^2$, square targets are most efficient for their area; the greater the ratio of length to width the greater the contrast required. Thus the visually critical region of a target is a ribbon just inside its perimeter and $\sim1'$ wide. Evidently, contrast is not judged over the area of a target, but across its boundary. A.

612.843.63 : 535.42 = 5 *see Abstr.* 3154

612.858.71 : 534.414 3391

Transient reception and the degree of resonance of the human ear. PUMPHREY, R. J., AND GOLD, T. *Nature Lond.*, **160**, 124–5 (*July* 26, 1947).—Measurements were made of the dependence on pulse-length of the threshold of audibility of pulses of different frequency. The higher the Q of the discriminatory resonator in the ear, the more cycles of exciting signal will be required to raise the level of excitation to a certain value, or alternatively, the higher the level of excitation required for a given number of cycles. The results indicate that the resonators in the cochlea have a Q of ~200–350 from 10–2½ kc/s, falling to 50 at 1 kc/s; it is likely that Q continues to fall with frequency. It is shown that the observed frequency discrimination >1 kc/s is consistent with, and only with, Q values of this order.

614.485 : 621.327.31 3392

Killing bacteria in water under pressure. LUCKIESH, M., [illegible]RR, G. P., JR., AND KNOWLES, T. K. *Gen. Elect. Rev.*, 16–21 (*May*, 1947).—The design, performance and maintenance of arrangements for sterilizing water by the action of radiation (mainly λ2537) from mercury lamps are described and discussed. C. B. A.

6[illegible]898 : 539.16.08 3393

Measurement of radioactive radiations in a luminising room. BRAUDO, C. J. *Metrop.-Vick. Gaz.*, **22**, 48–51 (*March*, 1947).—Industrial hazards arising from the use of radioactive luminous compounds are reviewed and British and American tolerance limits summarized. A short description of ionization chambers and associated electrometer circuits used for measurement is given and methods of calibrating the chambers are discussed. Investigations were carried out in a specific luminizing room showing that the working conditions in the room are safe. No relation could be traced between the radon content of the breath of the operatives and the time worked in the luminizing room. Ventilation requirements are reviewed for the case of both dry and wet painting.

615.831.7 : 535.23.08 *see Abstr.* 3103

GLASS . CERAMICS 666

666 : 535.65 *see Abstr.* 2859

666.1.037.5 : 539.4.016 3394

Stresses in glass-to-metal bead seals at room temperature. REDSTON, G. D., AND STANWORTH, J. E. *J. Soc. Glass Tech.*, **30**, 201–16 (*T*) (*Aug.–Oct.*, 1946).—A photo-elastic study has been made of the distribution of the retardations due to axial stresses and due to radial and hoop stresses in bead seals. Seals of varying glass–metal radius ratio, b/a, were tested. The observed distributions of retardation agreed substantially with those derived from the mathematical theory [Abstr. 336 (1946)]. Direct determinations of axial stress, however, became unreliable with seals of high glass/metal radius ratio and also with short seals. Brief reference is made to practical applications of photo-elastic measurements of bead seals. A.

METALLURGY 669

669.018 : 548.7 *see Abstr.* 3357

669.355 : 539.32 : 548.7 *see Abstr.* 2692

PHOTOGRAPHY 77

771.448.1 : 535.33 : 535.89 *see Abstr.* 3170

771.534.2 : 771.534.562 3395

Spectral variations of the intermittency effect for some panchromatic plates. HOPWOOD, W., AND CRAGGS, J. D. *J. Opt. Soc. Amer.*, **37**, 560–5 (*July*, 1947).—Experiments have been made to determine the response of photographic panchromatic emulsions to light flashes lasting only a few μsec. Previous experiences of other workers and general photographic theory tended to show that the spectral response of plates should show no intermittency effect, i.e. should be the same for short flashes of light and for steady illumination. This was found not to be so and experimental data are provided. A.

771.534.56 : 535.242.43 : 522.617.2 *see Abstr.* 3008

771.534.562 : 771.534.2 *see Abstr.* 3395

778.3 : 537.133 : [illegible]39.164.1 *see Abstr.* 2967, 3300

778.33 : 535.376 4 *see Abstr.* 2849

778.33 : 620.179.1 [illegible],621.386.1 3396

One-millionth-second radiography and its applications. SLACK, C. M., AND DICKSON, D. C. *Proc. Inst. Radio Engrs, N.Y. Wav. Electrons*, **35**, 600–6 (*June*, 1947).—[Abstr. 2533 B (1947)].

778.33 : 621.386 3397

Data on the German X-ray industry. *JIOA Rep.* (*No.* 46) (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 81 *pp.* (1947).—[Abstr. 2815 B (1947)].